COMPUTERS AS A PLANNING TOOL

A REFERENCE HANDBOOK

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HOW TO...

This document is a reference handbook on the Use of Computers for planners. An attempt has been made to bring together in one volume all of the basic information a planner would normally need in understanding computers and their role in planning.

The handbook is designed to provide the planner with a quick method of accessing desired information . Each major part of the handbook can be read separately depending upon the user's level of interest. These parts are easily identified by their distinctive edge markings.

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PREFACE

Computers are a fact of life. The question is not whether planners need the computers to improve the services they provide but how should they adapt to using this new, powerful tool.

This report aims to expose planners to the various aspects of computer use. The information in this publication is sufficient to enable a planner to get started and further explore areas of interest. The document is structured into various parts, each of which stands on its own. It is not necessary to read this report in sequence. Rather, it is intended to serve as a reference – to be read selectively.

It is stressed that the developments in computer hardware and software are rapid indeed. The information provided in this report is as up-to-date as possible. However, the reader should follow up other available sources to keep in touch with the new developments and products in this field.

It should be noted that using computers is essentially a learning process. The best dividends from their use are not dependent upon purchases of expensive equipment or sophisticated programs but on being able to use a few selective programs effectively. The planner would need to spend a reasonable amount of time to learn the selected package – and this is normally not a difficult task.

It is hoped with the use of this publication that a planner can take the first step of choosing and making some immediate use of computers. There are three levels of approach suggested. The first two are relatively easy approaches described in Part 1. A more comprehensive step-by-step process is outlined in Parts 3 and 4.

INTRODUCTION

The purpose of this report is to enable practising planners to understand and make appropriate decisions in choosing and making practical use of computer technology in their workplace. The focus of this report is the work which planners do and how computer technology can complement their work. A planner is guided through the information on available hardware and software and provided with a procedure for selecting a configuration best suited to his/her needs.

Although it is true that community planning did not easily lend itself to effective computer use, the fit between planning and computing is growing closer as hardware systems become cheaper and easier to use and software systems become more flexible and able to accommodate the needs of municipal planners.

In the past, programming skills and related expertise were invariably essential for using computers since most applications were custom made. Moreover, computer time was expensive. Planners' needs did not fit with these requirements. The planner was usually an occasional user for one-shot special studies dealing with land use, transportation, or predicting the future allocation of socio-economic variables.

Today, to use a computer a planner need not be a computer expert or a programmer. However, a planner should have a basic understanding of computers and application programs, what a computer can and cannot do, organizational requirements of a computer-oriented office and the ability to organize, store, retrieve and manipulate the information by using a computer. One should also be able to make intelligent decisions regarding what equipment and programs should be purchased.

The main value of computers and automation to any planning office lies not so much in improving productivity or faster service but in the realm of providing better information tools for planning and control.

It should be emphasized that two major obstacles to using computers (cost and skills) are slowly being removed. Computers are rapidly becoming affordable and easy to use. However, other factors, such as organizational requirements, decisions regarding the type of data base to be established, communications to link with outside information and the need to establish an efficient system to produce required results are likely to grow in importance and complexity. A planner must face up to this challenge if he/she wishes to fully benefit from emerging information technology.

This report is an attempt to help planners understand computer use and provide them with practical and effective means of using computers in their work environment.

STUDY BACKGROUND

Until recently, the use of computers in planning was somewhat limited in Ontario municipalities. During the past six or seven years, however, it became evident that their use was accelerating – even though planning staff in many municipalities were not fully prepared to benefit from computer technology and make the decision to purchase the appropriate computer hardware and software.

In 1981/82, the province decided to take an overview of the use of computers in plannning across Ontario. Information on hardware, software and planning applications assisted by the use of computer was collected. Eighteen municipalities were surveyed. The results of this study were published in a report entitled "The Use of Computers in Planning – An Overview of the Ontario Situation", dated March 1983. The report not only provided the results of the survey undertaken but also a general review of the use of computers in the planning field. Major areas of application were also discussed.

SCOPE OF THE PRESENT STUDY

The 1981/82 study concluded among other things, that:

- The use of computers in planning offices would increase more rapidly.
- Planners need to know what software is available, what planning functions can be assisted by using available programs and what kind of

operating environment is required to run such programs.

The present study includes these additional concerns as well as a more recent survey on the use of computers in planning offices. It aims to provide a methodology which can be used by planners to select appropriate software and hardware in order to carry out specific planning tasks. A section is devoted to the rapidly increasing use of microcomputers in planning. The results of the new survey are outlined and compared with the previous survey to highlight major areas of change.

The report also provides a software directory which lists all major programs presently available to planners.

Detailed information about a number of application areas which are of interest to planners is *not* provided in this report. For example, detailed discussion and techniques of developing a database management system, a computer-aided development control system or undertaking digital mapping would require separate studies. In this regard, the present report goes only as far as providing a basic understanding of various planning activities and the identification of available computer programs which can be used.

The report is comprised of four parts:

Part 1 **The Basic Understanding** . This part is for the reader who wants to start the use of a computer with the minimum of fuss and some assurance of success.

Part 2 **The Use of Computers in Planning – An Overview** . This provides a brief commentary on the use of computers in planning generally, and a discussion on the results of the 1981/82 and 1984 surveys of Ontario municipalities.

Part 3 **Guidelines On Using Computers for Planning Applications** . This discusses the use of generic software in planning, as well as more specialized use of computers in planning applications. The chapter provides guidelines on choosing appropriate software programs and related hardware to carry out specific planning tasks.

Part 4 **Selecting and Using a Microcomputer System** . Due to their increasing popularity and importance in planning offices, this part is devoted to exploring strengths and weaknesses of using microcomputers in planning.

1

THE BASIC UNDERSTANDING

PART 1
THE BASIC UNDERSTANDING

A DIRECT APPROACH

For those planners who want to jump into the deep end and take the direct approach to using a computer, there is one obvious course of action: go out and purchase a microcomputer and one compatible integrated software package that has the capability of carrying out normal functions of a planning office. This costs approximately $10,000 and is relatively inexpensive, since costs are continuing to decrease to levels unheard of a few years ago. However, the risk of purchasing inappropriate hardware and software is greatest if this approach is adopted by a novice in the computer field.

The computer hardware will include a microcomputer (consisting of a processing unit, keyboard, and a visual display screen or monitor), two disk drives, and a printer. The software package gives, at least, a capability to calculate numbers, test assumptions, and analyze the results with a spreadsheet, illustrate and analyze trends by drawing graphs from numeric data, and organize and manage information entered in a database. Some programs also include the capability to write and edit documents electronically using word processing, and exchange information with other computers through data communication. In other words, all the administrative and most of the technical tasks of a planning office can be undertaken by using one software system.

The self-training to use the microcomputer satisfactorily can be done in about 30-40 hours of practice. There are the comprehensive manuals provided by the hardware and software manufacturers, and in some cases a tutorial disk comes with the software. If there is still a problem, there are many excellent short-term commercial training courses available on the most commonly used programs.

This direct approach will ensure that a planner gets on to the information bandwagon with the minimum of fuss and the maximum of opportunity to stretch his/her ability. For the bold this is the way to go. The alternative in many cases may well be to procrastinate and get left behind.

This direct approach which offers a short cut to computerization is recommended for a small planning office only where resources do not allow a more comprehensive approach (discussed later) to be taken. The planner should study Part 4 before selecting the microcomputer to be used.

A LESS DIRECT APPROACH

Some planners, on the other hand, may want to identify and answer some essential concerns at a basic level before they make the decision to use a computer in their offices. They may want to go through a process and examine the following aspects of the situation:

- Before purchase
- Purchase process
- Training
- Initial use
- Extended use

BEFORE PURCHASE

Not every planning department needs a computer to be more efficient or provide a better quality of service. The day-to-day operations in a very small planning office can still be carried out efficiently with traditional office equipment and filing systems. However, since the cost of a microcomputer is now very modest (and still falling) and there are good quality, low-cost general purpose programs available to run on these machines, it is almost certain that within the next five to eight years the computer in a planning office will be as common as the photocopying machine is today.

The very first thing a planner should do before purchasing anything is to answer the following question: what will I do with a computer in my office?

It is important to provide a precise answer. If there is an appropriate answer, the next step of deciding what to purchase becomes easier. Later, some of the most common initial uses are identified. The planner should choose from these what is best suited to his/her circumstances.

Once the initial use of a computer is identified, some basic considerations should be taken into account before the purchase of equipment and programs:

- Find out what programs will be suitable to carry out the desired tasks. Consult the systems people, talk to other planners and do a little literature search to get familiar with the available programs. In most cases, a planner would choose general purpose programs such as a word processing package, a spreadsheet program and a data base management package.
- In choosing a particular program it is essential to know, for example, how much memory space it will need. Most microcomputer programs require a memory space of 128K – 320K. More recent integrated programs like Lotus 'Symphony' require a memory space of over 320K.
- What is the operating system required to run the program? Programs are written for specific operating systems. Try to choose a program which uses one of the most common operating systems such as CP/M or MS-DOS, since it would be easier in future to purchase additional software when expanding the use of the computer.
- It is also important to choose the programs which are well documented and supported by the manufacturer.
- Concentrate on the basic equipment, that is, a computer system comprising of a keyboard, a visual display unit (or monitor), disk drives (preferably two), and a printer. Other peripherals such as plotters, modems, or digitizers should only be bought later, if and when their need is established.
- If word processing is a major (say 80%) anticipated use it is best to get a dedicated word processor and a separate unit for other applications. Word processing on a normal personal computer is more difficult.
- If microcomputers are being used in other departments within the municipality it is advisable to buy equipment which is compatible. This will ensure easy exchange of programs or files.
- The equipment to be purchased should have expansion slots to accommodate future add-ons such as plotters or linkage to other computers.

PURCHASE PROCESS

The purchase process should not present a difficult problem once the decision to buy specific equipment and programs is made. However, it will be helpful to remember the following points:

- It is best to buy microcomputers instead of leasing or renting. Mainframes and minis are usually leased.
- The selected programs must be tried out on the equipment which is being purchased to see if everything works.
- It is better to buy from vendors who can offer assistance in case of breakdown or problems with the machine.

TRAINING

- The staff should be trained on the specific programs to be used. Training courses that offer overall computer awareness are useful but generally do not help to run application software.
- Programming courses are not needed unless substantial in-house programming is anticipated. To run commercial programs no programming knowledge is required.
- It is important to remember that it requires a reasonable amount of practice (after learning to operate a program) to become comfortable with its use. A period of four to six weeks of constant use should be allowed for this purpose.
- Tutorial disks provided with various programs are useful. However, too much time should not be spent on them in an effort to learn everything. Real learning comes from the use of actual programs on a real-life project.

INITIAL USE

To start the ball rolling and get some immediate useful return from the investment, a planner should consider some basic applications:

- Word processing could provide the best and immediate benefit. Word processing can be used not only to take care of a department's typing needs such as daily letters, memos and reports, but also serve as a useful tool for record keeping of council minutes, O.P. and zoning by-law documentation, consolidation and amendments, and mailing lists. If used properly the investment in the computer can be justified on this application alone.
- Administrative functions such as a department's budget, staff-time management, inventories, etc. can be entered on a computer using a spreadsheet program. These applications are very easy to start with and provide a training base for more sophisticated applications.

- Zoning and subdivision application data can easily be put on the computer. The data then can be up-dated and manipulated as desired. A spreadsheet program with data base management or an integrated program is needed.

EXTENDED USE

Depending on the size of the planning office and the problems encountered, it is possible that a large number of planners may limit their computer use to dealing with administration, data banking and manipulation, and word processing. There may be some offices who will decide to go forward and use the computer for mapping, communication with other computers, the establishment of more sophisticated data banks, and graphics. The horizons of use are not yet that clear for community planning, but some indication is given later in this document.

A LEAST DIRECT APPROACH

There will be some planners who may wish to discard both these direct approaches, and take a more circumspect look at the necessity for using a computer. Parts 3 and 4 of this publication can be used as a guide to an extended process that could decide both the need and specification of equipment and software.

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THE USE OF COMPUTERS IN PLANNING - AN OVERVIEW

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PART 2
THE USE OF COMPUTERS IN PLANNING - AN OVERVIEW

A GENERAL OVERVIEW

BRIEF HISTORY

About ten to fifteen years ago computer use in planning was restricted to large planning departments. In fact, these departments were in the forefront of non-financial computer applications. Major activities where a computer was used included land use transportation studies, forecasting and modelling.

This was a time when computers were large and expensive (referred to as 'mainframes') and were purchased primarily for financial applications. Due to the high cost of computer time, lack of access, non-priority status and lack of programming and operating skills, most planners never used a computer. Major planning applications where cost and the amount of number crunching could be justified were carried out either through a service bureau or with the help of systems people within the organizations. In both cases all data was packaged together and custom-made programs written for that particular application. Once the results were obtained, the data and the program were usually discarded with little intention of using them again.

In rare cases mainframes were used to assist in other planning activities such as a property information data bank or a planning applications record and monitoring system. However, these applications remained modest due to the various constraints such as limited capacity, high cost, lack of access, batch processing and competition for computer time with the other departments, especially a Finance Department. During this period large and complex information systems were envisaged but were not realized either because designers were not available or the technology was too expensive.

During the late 60's and early 70's two major developments took place. First, minicomputers came on the market. These machines were still expensive, around $300,000., but relatively affordable. Many planning departments were able to have their own terminal hooked up to a mini or a mainframe computer. Second, service bureaus with their large computers became available. Anyone could open an account and share the computer time with direct access via a terminal. However, in many cases these systems did not fully satisfy the needs of planners, particularly smaller municipalities constrained by the high cost of computer time.

Microcomputers came on the market during the later part of the 70's. They are hailed by many as the solution to all the problems experienced with large scale "mainframe" computers because they are cheap, portable, can fit on a desk and provide complete independence to the user. However, two major obstacles proved a severe limitation to using them in planning. The capacity of earlier microcomputers was small, and even with external storage facilities on floppy disk, large amounts of information such as assessment or property information could not be all stored and accessed. The other even more severe constraint was the lack of software for planning applications. Most planners do not have programming expertise. They depend therefore on developed programs.

The use of microcomputers in planning thus remained limited for several years. Over the past few years there have been marked advances in microcomputer hardware, software and communications. Microcomputers are now faster, have large core memories and very large external online storage capacities. Application software for various microcomputers has been produced in large quantities – some of which can be used to assist in planning applications.

Microcomputers are no longer isolated standalone machines. They can communicate with mainframes or minicomputers, extract information from large data base systems and can be linked to other microcomputers in a network.

At present, planning departments in Ontario and elsewhere are actively experimenting with using computers for a variety of applications. A part of this report up-dates the existing situation.

MAJOR APPLICATIONS

The needs for using a computer in a planning office are not fundamentally different from those for other disciplines. The planning function contains elements of administration, information gathering, data analysis and production of reports and other services. It is possible to use computer assistance in all these activities.

The major applications in planning include:

- Development control and project management – This is an area where data must be converted in appropriate computer files and kept up-to-date.
- Statistical analysis – A major activity especially if planning studies and new surveys are being undertaken.
- Modelling and forecasting – Routine activity which must be carried out to check basic assumptions on which planning strategy is formulated. Monitoring of plans depends heavily upon this activity.
- Word Processing – Day-to-day activity facilitating the production of reports, address labels and other text. Word processing can also be used to permanently store and update important documents such as official plans, zoning by-laws, council decisions, etc.
- Mapping and graphics – Although it is basic to planners work, the use of computers in this field has been rather limited. Large storage requirement, the need to convert maps in the computer readable form and complexity of programming and using the system are the main reason for this limited use. However, things are looking up. Whereas it was a mainframe or mini application in the past, new micro systems can handle mapping and graphics.

A discussion of specific planning tasks and how to choose appropriate software will be given in Part 3.

MANAGEMENT RELATED ISSUES

It is not sufficient just to have appropriate hardware and software to make effective use of computers in planning. Awareness of management and related issues is essential. In this section some of the management and organization issues arising from the use of computers in planning are discussed.

The application of technology, even with the best of intentions, to enhance planning service will not produce the required results if the environment under which it is to operate is not fully understood. The environment consists of the political, professional and managerial elements and their expectations and perceptions of the role of information technology in the planning or policy process.

From the professional point of view, the development of specific applications using computers to support particular functions or analytical tasks is of central importance. Here, computer technology is seen as means of tackling the problem at hand in an efficient manner.

From the managerial point of view, however, integration and synthesis of data from a variety of sources must be achieved so as to enhance the rationality and increase the co-ordination of policy and management decision-making. Here, the underlying rationale is that more information capable of more systematic and comparative analysis leads to better decisions.

However, many information systems that were developed did not live up to their expectations. The benefits of such systems, in terms of enhancing information for management and policy making, cannot be realized unless:

- The integration of different data sets was achieved.
- The data was kept up-to-date.

This means that for a successful computer environment it is important that attention be paid to relationships between and difference in information needs of those at operational level providing and maintaining data and those at the central management level.

The third dimension in setting up a computer oriented planning office is the political viewpoint and expectations. Politicians are more concerned with efficiency and accountability and some quick return from investments. This obviously creates tension between the long-term view of long-range planning and research and the short-term political horizon.

It can be concluded from the above discussion that a computer based information system built around operational needs of planners will run into severe problems of mismatch between the expectations of management about utility payoffs and the actual level and time scale of financial commitment requires to achieve them. For a successful implementation of a computer system, therefore, it is important that active participation of all those affected by it should be ensured before initiating the system.

In developing a computer oriented information system the starting point obviously is to analyse what information is wanted by whom and for what. In part these questions can be addressed by reference to the particular functions within the department and relative priority placed upon them. More importantly, however, this question must be addressed in the context of the way the organization works. It should be noted that making changes to pieces of hardware and software is easier than making organizational changes. Thus having a system that works will depend not only on the right choice of hardware and software but also on sorting out how the organization wishes to operate.

THE SECURITY ISSUE

Fortunately, the security of data is usually not a major issue in planning departments. However, many other aspects of security do apply especially as the system becomes more complex and where it is connected to other computers for one way or two way communications.

Major concerns regarding security of computer systems can be summarized as follows:

- Unauthorized access to computer data.
- Electronic access from a distant or physical on-site terminal.
- Sabotaging of data by disgruntled employees or strangers.
- Theft of hardware and software.
- Unauthorized copying of software.
- Accidental loss of data due to an inadequate back-up system.

For most of the planning departments two of the above issues are most relevant. They are:

1. That whereas all users may be allowed to 'read' information from the computer data files, only the authorized persons should be allowed to change or update the existing information.
2. There should be adequate back-up provisions to protect data from accidental loss or damage.

However, physical security measures for the hardware and software should not be altogether ignored. Computer hardware and software should be in a proper secure place, attached or enclosed in appropriate (preferably custom designed) furniture, binders or enclosures. There should be a logging system for the every day users. Other users should not be allowed to use the system without permission.

To ensure that only authorized persons should be allowed to change or update existing information, special passwords can be given. For additional security the passwords should be changed every 6 months or so. Better still, call back devices can be installed to further check the identity of the user and cross reference it with the call-in line then calling back the user to allow access.

More comprehensive access control is provided by software packages that can check passwords, identification codes, track call-in lines, and provide audit trials to indicate who obtained accesss, when and for how long. However, these packages are very expensive and not suitable for most planning authorities.

For microcomputers the best security would be to use removable hard disks rather than the usual fixed ones. The removable disks cost about 50% more ranging from $1500 to $2500 (U.S.) per disk but are worth the extra expense if data must be stored in a safe place.

The planners should ensure that they always keep back-up copies of all the program and data files. When using the computer in a day to day situation, work should be saved frequently to save it from loss due to power shut off. Some 32 bit machines allow automatic back up working files every 15 to 30 minutes.

The security aspect of computerization should be handled carefully, balancing costs and convenience and deciding what needs be protected against what.

Finally, even the most elaborate security measures are ineffective if employees do not exercise proper care. Leaving a computer unattended without signing off is one sure way to break the security down.

As the use of microcomputer increases, specially coded cards may become popular to allow access to both hardware and software. The cards can be coded to give access to prespecified programs only, thereby eliminating unauthorized use.

SOME BASIC PROBLEMS

The stages of a computerization process are:

- Deciding what is needed in terms of hardware, software and data that will satisfy the goals of the organization as well as meet the operational needs of the user.
- Purchasing of equipment and software.
- Designing of the information system.
- Running the system.

It is not possible here to go into the details of various problems at each stage of the process since this would be a study on its own. However, some of the common obstacles encountered in producing worthwhile results using computers can be pointed out. They are:

■ Purchasing without adequate research

Purchasing expensive equipment and programs without first analysing departmental needs is one of the most common problems. If this step is ill-conceived a major portion of the investment could stand idle without being used at all.

- Poor operational skills

Getting used to the keyboard and acquiring operational skills take time and patience.

- Lack of motivation

Using computers is not that difficult, but no one really learns unless there is a real need. Nothing can be gained by trivial exercises like adding numbers or calculating areas. One needs a project worth taking on its own. Appreciation and practice will only come with results which could clearly not be achieved any other way.

- Unfamiliarity with programs

This is the hardest part. It takes time to understand and adopt a program to suit a particular need. There are very powerful programs available on the market. It will take patient learning and experimentation to utilize the full power of the program being used.

- Unavailability of required information or information being in the wrong format

When required information may not be available or it may not be in the proper format there is trouble. Many users forget that a greater effort is required in acquiring the relevant data than actually running the program to produce the results. If the data is defective results cannot be any better.

- Unsatisfactory output

After going through the whole process the final result can be below expectation, ambiguous or just not right. This can happen if there is a serious fault either in the operation of hardware, misunderstanding of applicable programs, poor designing of the job at hand or just bad input information.

FUTURE DIRECTIONS

The technological changes that are taking place in computer hardware, software and communications indicate that in future planners have a lot to benefit if they come to grips with the change. Given this, planners can in fact enhance their contribution to the society a great deal by furthering computer use in their work.

Human decision making is unlikely to be replaced by computer simulation models. However, the quality of decisions will improve through easier access to a variety of data and information made possible through computer linkages.

Technological change will have its manifestation in the following manner:

- Powerful and versatile machines
- User-friendly software
- Availability of better quality data
- Direct access to data banks and outside sources of information
- Continually falling costs of both hardware and software.

There are four basic data-related activities planners are involved in: collection, storage, processing and display of information. It is hoped that by using computers both the quantity and quality of these activities will be greatly improved. The likely improvements are:

- Data collection

Increasingly, data will be available from various sources in computer readable form. This means a large amount of data can be sorted to extract relevant data in a short time. Also, it will be increasingly easier to connect to a large data base, thus enabling the planner to tap outside sources not feasible in the past.

- Data storage and management

Computer capacities have increased many fold. Even microcomputers can now run very large programs which could only be run on much larger machines before. On-line storage capacity is becoming cheaper all the time. All this means is that neither the core nor auxiliary storage should be a constraint in the future. Planners would be free to load all the data they need without the fear of overshooting the capacity of the system.

The software to organize and manage data files is becoming easier and fairly sophisticated. The planner should, therefore, be able to handle the data and manipulate it without having to learn any special programming or other skills.

- Data processing and analysis

With the sophisticated software now available and coming on stream, planners would be able to use their desk top intelligent terminals for any processing, analytical, modelling or mapping exercises.

- Display and output

  Substantial improvements are expected in the area of geo-referenced information and digital mapping. Up until now this activity has been very limited due to technological constraints. These constraints are being eliminated now. High resolution graphic terminals, large memories, availability of geo-referenced information and possible links to mainframe systems such as remote sensing programs will enable a planner to call in information on any area, manipulate it, correlate it with other information, display it on monitors and prepare a report if necessary.

  The cost of microcomputer hardware has steadily declined to a point where hardware costs are no longer the major portion of computing costs. For all practical purposes the technical and economic constraints of computer use in planning are being removed.

  If relatively simple systems were put in place now, planners would be able to take advantage of advances in telecommunications and availability of sophisticated software that will allow them to explore more options and base their recommendations on a much more reliable information base.

AN OVERVIEW OF THE ONTARIO SITUATION 1981-1984

SURVEY INFORMATION

In this section the results of the 1981/82 survey and the present municipal survey are compiled to show what changes have taken place in the use of computers in Ontario municipalities during the past two to three years. The two surveys requested similar information on what planning functions are being assisted by computers in the planning departments and the nature of the hardware and software in use.

A total of 31 municipalities were surveyed, compared to 18 that participated in the 1981/82 survey. There are 105 municipalities in Ontario with planning departments.

The following is a list of the municipalities that participated in the 1983/84 survey:

City of Brampton
City of Burlington
Town of Caledon
City of Chatham
Regional Municipality of Durham
County of Essex
City of Guelph
Regional Municipality of Haldimand-Norfolk
Regional Municipality of Halton
Regional Municipality of Hamilton-Wentworth
City of Kitchener
City of London
City of Mississauga
Town of Newcastle
Town of Newmarket
City of Oshawa
City of Ottawa
Regional Municipality of Ottawa-Carleton
Regional Municipality of Peel
City of Peterborough
Town of Pickering
City of Sault Ste. Marie
City of Scarborough
Town of Stoney Creek
Regional Municipality of Sudbury
City of Thunder Bay
City of Toronto
Metropolitan Toronto
Regional Municipality of Waterloo
City of Welland
City of Windsor

The format of the 1983/84 survey was slightly different from the previous survey. The new survey had four parts: hardware, software, planning applications and general information. Some of the details collected in the previous survey were eliminated. The reader is encouraged to contact other users and producers of hardware and software for more detailed information.

This report also provides a software directory which should be referred to if further information is required on programs selected for possible future use. The 1983/84 survey information is presented in Appendices 3 and 4 Municipal Survey Information for easy and quick reference.

COMPUTER HARDWARE

The following are some of the main findings from the survey on the computer hardware in use:

- The 1983/84 survey and the 1981/82 survey, found that planning departments do not have an exclusive use of a mainframe. They either share a municipal mainframe, usually located in the finance department, or use an outside computer facility such as that of a service bureau or a university.

- The 1983/84 survey found that fewer municipalities use only their municipality's mainframe than in 1981/82; today four of thirty-one municipalities use mainframes only, compared to fifteen of the eighteen municipalities in 1981/82.
- In 1983/84, there were three, and in 1981/82 there were five municipalities surveyed that utilized private agencies for their computing needs. Six municipalities in 1983/84 and five in 1981/82 made use of a university computer. The Ministry of Transportation and Communications computer was used by four municipalities in 1983/84 as in 1981/82.
- The various outside agencies used include: Canada Systems Group (Mississauga), Data Max Inc., Data Crown, Ministry of Transportation and Communication and various universities.
- In 1981/82, the City of Toronto was the only municipality with computer connections to another municipality outside the region. This connection, to Ottawa, is no longer in existence according to the 1983/84 survey.
- There is a wide variety of mainframes used in municipalities including nine municipalities who use IBM (131, 360, 370, 3270, 3276, 4331, 4340, 4341, SYSTEMS 36, SYSTEMS 3) and four municipalities who use Sperry Univac 1100. The other municipalities use the following mainframes: GIAC 800, ICL ME 29, Honeywell DPS 6/54, Honeywell DPS 8/49 and AMDAHL 580/5850. Both surveys showed the majority of municipalities using the IBM mainframe.

Type of Computers Used By Planning Departments in Ontario 1981/82 and 1983/84

Survey	Mainframe Computer Only	Micro – and Mainframe Computers	Micro-Computer Only	Mini-Computer Plus Others	Total
1983/84	4	20	1	6	31
1981/82	15	2	0	1	18

- Microcomputers are more extensively used since 1981/82, because of their fairly low cost and ease of operation. Twenty municipalities use both the microcomputer (including word processors) and the mainframe and one municipality makes exclusive use of the microcomputer in their planning department. By contrast, in 1981/82, only two departments were using microcomputers.
- Six municipalities use minicomputers in their planning departments. The types of minicomputers include: ICL, MAI BASIC 4, IV PHASE, PDP 11/44 and Wang US90.
- Half of the municipalities who use microcomputers make use of the IBM PC. The other microcomputers used include: TRS 80, WANG PC, HEWLETT PACKARD, APPLE III, IP SHARP, HONEYWELL, DEC VT180 and DEC RAINBOW 100.
- Twenty-one of the thirty-one municipalities surveyed in 1983/84 have word processing capabilities. Fourteen municipalities have systems dedicated exclusively to this function while seven municipalities use other computers for word processing (micro, mini or mainframe computers).
- Many municipalities suggested that when considering computerization, the following factors should be addressed: identify what the computer will be used for, find out what other agencies and municipalities are using to solve similar problems, and purchase only well-documented programs.

COMPUTER SOFTWARE

There are 86 commercial software programs which are being used by the 31 planning departments surveyed today. This is an increase of over 70 commercial software programs since 1981/82. The following table lists the variety of commercial and other programs and packages in the 31 surveyed municipalities:

Types of Computer Packages

	Commercial Packages	Other Packages/ Programs
1. Training	5	0
2. Integrated	4	0
3. Statistical analysis	5	2
4. Transportation planning	6	3
5. Spreadsheet	6	0
6. Word processing	15	0
7. Database management	16	8
8. Mapping/graphics	4	0
9. Mailing lists	1	0
10. Communications	8	0
11. Forecasting	2	5
12. Retail modelling	2	3
13. Miscellaneous (includes non-application soft-ware such as compilers)	12	1
	86 Total	22 Total

The following are some general observations from the survey of programs and packages in use:

- The recent survey showed that commercial software programs are more extensively used than the other packages/programs. The 1981/82 survey showed that only a half dozen commercially available software programs were being used by various planning departments. There are over 75 new commercial software programs used today and they are mainly microcomputer packages. Appendix 2 outlines the commercial and non-commercial programs in use in Ontario as well as programs most commonly used.
- The number of commercial software programs has sharply increased due to the popularity of microcomputers and the relatively low cost software programs which can be adapted to planning.
- SPSS (Statistical Package for Social Sciences) is still the most popular package used. However, the number of municipalities using this package has not increased since 1981/82.
- The interest in RISC, which manipulates assessment information still continues. Six municipalities still continue to use this regional information program.

PLANNING APPLICATIONS

Appendix 1 contains a summary of the planning applications in which a computer is used in the surveyed municipalities. Planning applications are divided into six broad groups.

The following are some observations from the survey:

- The majority of municipalities, that is, 23 of the 31 municipalities surveyed, have assessment data files on the computer. All of the municipalities interviewed in the previous survey had assessment data files on the computer.
- Data banking and word processing are the most common applications in municipalities as shown in the following table.

Application	Number
Data Banking	29
Data analysis	18
Modelling and forecasting	19
Mapping	4
Graphic	10
Development control	22
Administration and budget	18
Word processing	27

- Some municipalities noted problems with the reliability of assessment data.
- The nature and complexity of data files varies widely. Some municipalities utilize the computer's data banking capabilities for rental and assisted housing inventories, land use data, industrial land inventories and development control information (official plan, zoning by-law, site plan control, etc.). Less common computer data files include census data, commercial land inventory, transportation, survey and employment data.
- The recent survey indicated that two municipalities, the Regional Municipalities of Halton and Waterloo, have environmental impact data on the computer. Information stored in these files includes data on environmentally sensitive areas, hazardous areas, natural resources, land use, soil types, etc.
- Sophisticated analysis of computerized data files is limited. The most common form of data analysis is the generation of data for reports.
- The second most common form of data analysis is the summary and tabulation of survey and statistical data. Other forms of data analysis include planning applications data, census data and monitoring activities such as development activities, staff and/or status of various files.
- The Regional Municipality of Ottawa-Carleton intends to process survey data on the microcomputer rather than the mainframe.
- The City of Toronto, Metro Toronto, the Cities of Ottawa, Mississauga, Sault Ste. Marie and the Regional Municipalities of Durham, Ottawa-Carleton, Sudbury, Halton, Waterloo, Peel and Hamilton-Wentworth operate relatively comprehensive data base systems. In both surveys, the City of Toronto had the most elaborate data base system.
- The Regional Municipality of Durham, Metro Toronto, and the City of Toronto are more extensively involved with modelling and forecasting. For example, the range of modelling and forecasting done in these municipalities includes population modelling, employment forecasting, retail assessment forecasting, fiscal impact forecasting, land use forecasting, housing forecasting and transportation modelling.
- Both surveys indicated that direct access and manipulation of computer information for development control purposes was rare. This lack of use is surprising since the development con-

trol process is assisted by computers (record keeping or generation of address labels) in many municipalities. The most active users of the computer for development control are the Cities of Toronto, London, Ottawa and the Regional Municipalities of Ottawa-Carleton and Durham.

- Computer graphics and mapping are still rarely used. The examples of their use include the Regional Municipality of Hamilton-Wentworth which uses colour graphics on the Hewlett Packard, and the Regional Municipality of Sudbury which has thematic mapping capabilities.

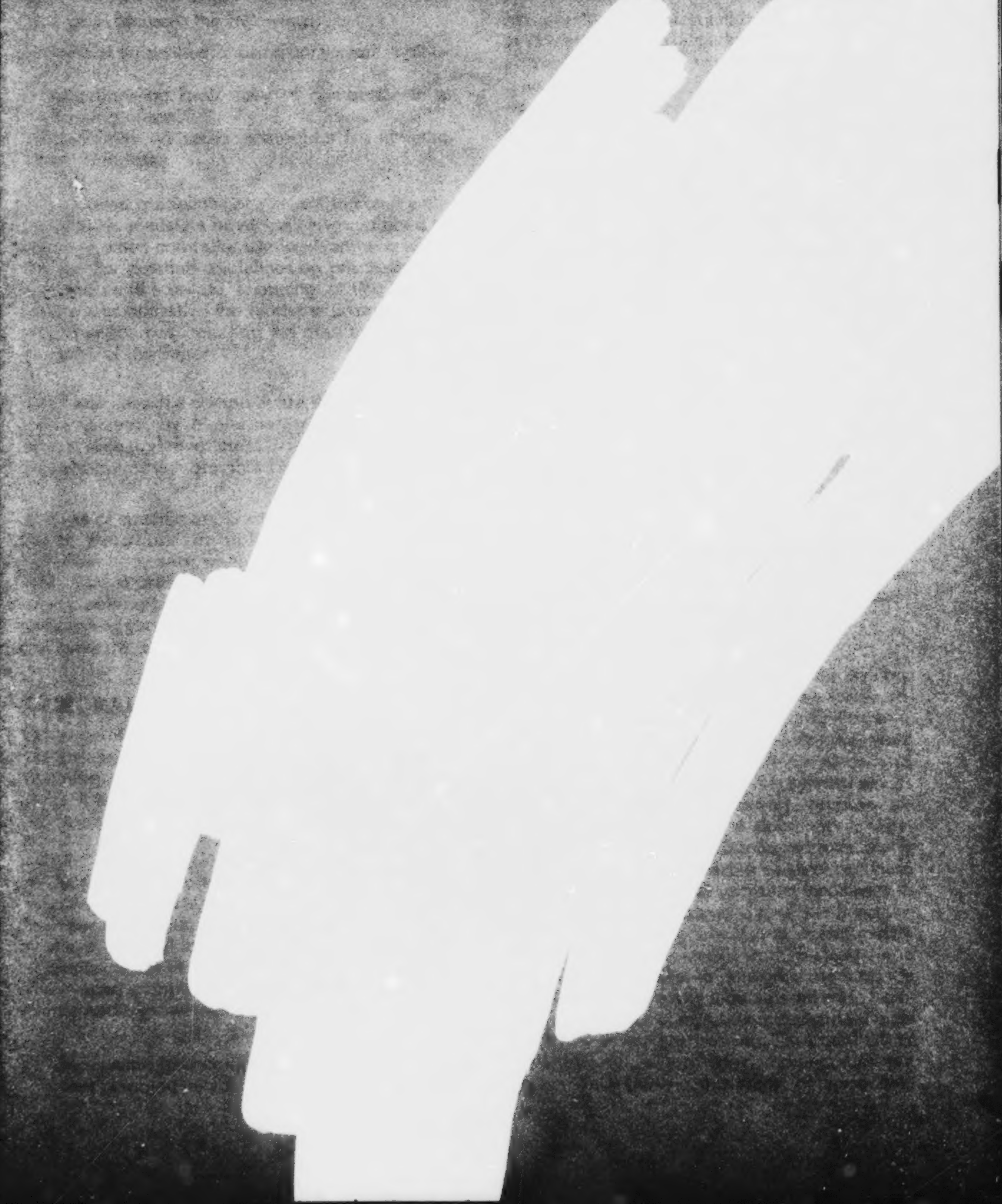
CONCLUSION

The present municipal survey shows some interesting changes that have taken place in the use of computers in Ontario municipalities since the 1981/82 survey. For example, microcomputers have become an important planning tool since 1981/82. Some municipalities found that most analytical work done in their planning departments can be done using the microcomputer, while mainframes are only required for large models and data banks. As a result, many municipalities are using a microcomputer either alone or in combination with a mainframe.

When considering the microcomputer, some suggestions made by the municipalities include: purchase a system that can handle both word processing and a data base in order to undertake a planning analysis, and consider a minicomputer with several work stations as a possible option to buying several micros.

3

GUIDELINES ON USING COMPUTERS FOR PLANNING APPLICATIONS



PART 3

GUIDELINES ON USING COMPUTERS FOR PLANNING APPLICATIONS

This part discusses the following:

- General guidelines for using computers in planning
- Guidelines on basic uses of computers in a planning office
- Guidelines on using computers for specific planning tasks

The general guidelines are meant to cover only the obvious matters a municipality would need to consider when computer use in planning is to be started. For detailed guidelines on purchasing of hardware and software, financing, setting up the system and operation the reader is urged to consult other sources including the ones in the bibliography of this report.

The basic uses of a computer are those which can be employed by a planner with minimum of preparation and investment. The use of some generic programs is highlighted in this section.

The use of specific application programs, custom made programs or in-house programming becomes necessary when a planner is relatively advanced in using computers. This section correlates planning tasks to both generic and specific application programs, which in turn are listed in the software directory.

GENERAL GUIDELINES

Selection of appropriate software and hardware is the first step to the successful use of computers in planning. To assist in making the required decisions, it is suggested that a planner consider the following:

- Acquire a basic understanding of what computers are, that is, to know different types, computer components and functions, types of software, typical computer configurations, an appreciation of the strengths and weaknesses of using computers, typical problems in their use and a knowledge of computer terminology.

- Understand how computers are being used in other planning jurisdictions. This would involve bringing together information on computer use in various planning departments in and outside Ontario. The planner would need to know the type of software and hardware in use as well as specific planning tasks being assisted by the use of computers.

- Undertake an analysis of departmental functions and activities – isolating these activities or functions which take up significant staff time or which are not being done satisfactorily due to time constraints. At the same time, consider what additional activities could be undertaken if computer assistance is available.

- Determine what software is available on the market that can help in the identified activities. If packaged software were not available to meet the need, the planner would need to investigate the possibility and costs of custom made programs. It is useful to assess any suitable resources available from the municipality, consultants, universities, or other jurisdictions, and the possibility of adopting those programs. If packaged software is available, determine its compatibility with the equipment that is expected to be purchased.

- Determine what kind of computer system would best suit the needs. This step would require an analysis of how the organization as a whole is functioning at the present time, what computer systems, if any, are in place and whether or not the planning department would benefit from exploiting existing computer resources instead of going it alone with a separate system for the planning department. Many other options would need to be explored here – hooking up to central computer facilities with terminals in the planning department, acquiring smart terminals which can communicate with the main computer or work as stand-alone computers, a local area network system for the department with many terminals linked to a single processor or completely independent units for data and word processing. The possibility of linking terminals to outside computers such as a service bureau or a university, or large data bases such as INFO-GLOBE should be investigated.

- Explore other options such as contracting out computer-related work or using someone else's computer such as a university's for any computing needs. This option is cost effective if computer requirements involve ad-hoc computing such as annual population or housing forecasts or manipulation of survey information.
- Determine what hardware should be purchased, rented or leased that will meet the software and organizational requirements. It may not be necessary to purchase all the required hardware at once. An incremental approach where a single system is put in place and then expanded is probably the best way to learn and use computers.
- Establish data needs that will fuel the computer operations very clearly. It is frustrating to have all the required hardware and software in place and then find that the data is either insufficient or incorrect. It should be remembered that acquisition of data to be stored in a computer is the single most time consuming factor. It is estimated that data acquisition can take up 80% or more of staff time. It is crucial therefore that data which will actually be used must be identified and collected in the proper format. Some people make the mistake of collecting all sorts of data in the hope that it will be used. This can not only choke up the computer capacity but also undermine the efficiency that can be achieved using computers.
- Determine required changes in the organization that will be needed to accommodate the use of computer as one of the main activities. It may be required to train staff, re-allocate responsibilities and functions and generally streamline operations to achieve maximum efficiency.
- Seriously consider hiring a consultant to set up the computer system especially if some complex applications are being contemplated. They should be brought in early at the user requirement definition stage. The terms of reference should include relevant points mentioned in this section.

It will be clear from the above discussion that choosing computer hardware is not the first or most important aspect of computerization. In fact, with the price of hardware falling rapidly it is no longer a significant cost factor. Other considerations must take precedence over hardware requirements which can easily be resolved once other important issues have been settled.

This report in its various sections provides adequate basic information in order for planners to use computers. However, the reader is urged to read other publications which deal more thoroughly with certain aspects such as microcomputers, hardware selection or reports on specific planning applications.

GUIDELINES ON BASIC COMPUTER USES IN A PLANNING OFFICE

If a planning department is computerizing for the first time, or wishes to use limited funds to maximize gains, it should find the information in this section useful.

Today, a planner, with a minimum of effort and investment and without any prior computer skills or programming knowledge can in fact use computers in many useful ways.

The purpose of this section is to highlight a very basic hardware configuration and some general purpose, commercially available packaged programs which can be used, in fact, to carry out a variety of planning tasks.

A BASIC HARDWARE CONFIGURATION

Just to get started a planner would need a microcomputer consisting of:

- a processing unit
- a key board
- a visual display screen or monitor
- two disk drives
- a printer.

With the above equipment in place many of the basic tasks can be carried out. The choice of a particular piece of equipment primarily depends upon the type of programs to be used. Various hardware configurations and additional equipment such as MODEMS and plotters are discussed in more detail in Part 4 (Microcomputers) of this report.

GENERAL PURPOSE SOFTWARE PROGRAMS

General purpose software programs are capable of performing a variety of related tasks. They usually require active participation between the operator and the computer using a series of standard commands.

General purpose programs include the following categories:

- spreadsheet
- word processing
- database management
- communications
- integrated.

Spreadsheet packages

For almost every microcomputer a spreadsheet program is available. This program is so versatile and so useful that buying a microcomputer for using just one package can be justified, provided the package is used effectively. It allows a user to electronically prepare a matrix of rows and columns for easy manipulation of numbers such as population, employment data, other statistics or inventories, etc. The package is very useful in answering "what if" questions. For example, "what if retail floor area is increased by 10% ... etc."

Generally, the spreadsheet is like an empty page of graph paper of columns and rows, except that it is much larger. For each cell, at the intersection of column and row in the spreadsheet, a user can enter:

- a number
- a label or title
- a formula making that cell dependent upon one or more of the other cells in the matrix.

The fact that computation of specified cell values can be made automatically in a spreadsheet makes it a very powerful tool in doing various planning analysis such as population, employment and forecasts, budgets, inventory control, etc. A simple example (Lotus 1-2-3) by way of explanation is given below. This is a small portion of the spreadsheet:

	Columns				
	A	B	C	D	E
	1				
	2	20	80	(B2+C2)	(B2/C2)*100
	3				
Rows	4				
	5				
	6				
	7				

For example, enter values of 20 in B2, and 80 in C2. To show addition of B2 and C2 in D2 and percentage of B2 to C2 in E2, and using the spreadsheet commands, a formula (B2 + C2) can be entered in D2 and the formula (B2/C2)*100 can be entered in E2. Upon entering the formulas, values of 100 and 25 will appear in cell D2 and E2 respectively. From this point on, if values are altered in B2 or C2 the computed values in D2 and E2 will automatically be recalculated.

It should be specially noted that using a spreadsheet does not require any programming knowledge on the part of user. All one is required to do is to enter values, labels and formulas correctly using various commands designated in various menus provided in the package.

The strength of the spreadsheet is in its continuous use and practice. A planner can test the effect of any of the assumptions by changing the relevant entries, and the spreadsheet will automatically recalculate all other information based on that change in other cells.

Other characteristics of a spreadsheet are:

- The output can be saved as a matrix or as a data file to be used in non-spreadsheet applications.
- A model can be recycled as a template for other applications, preserving the integrity of the original.
- Contents can be further manipulated using other programs (such as graphics) in an integrated package.

Some of the common spreadsheet applications are:

- Forecasting – Socio-economic or any numeric data forecasting can easily be done using a spreadsheet. Projections can be done based on assumptions built into the data. For example, the market share of various retail outlets can be entered into columns and the forecasted share calculated based on given formulas. Similarly, expected future population of a geographic unit can be derived through a mathematical model which includes age groups, birth/death rates, migration, etc.
- Modelling – Spreadsheets are flexible enough to accept a wide variety of models such as forecasting models, spatial allocation models, or simulation models, such as transportation models.
  Although transportation modelling is a separate field in itself, some traffic related studies can be done with the help of a spreadsheet. For example, traffic and transit utilization studies, or traffic implications of various land use assumptions can be tested and evaluated using spreadsheets.
- Standard functions – Most spreadsheet programs include pre-written functions to allow the user to perform a number of standard calculations – statistical tests such as mean, median, variance, standard variation, trignometric functions and financial functions such as net present value and internal rate of return. These functions can be called upon with a few keystrokes.
- Feasibility studies – One can store various data in files. The data can then be called up for evaluation in a spreadsheet. Sensitivity analysis

of one or more variables in relation to market or financial data can then be carried out. Feasibility of certain actions can therefore be demonstrated.

- Alternative analysis – The implications of plan alternatives may be tested out against established criteria. A great number of alternatives can be tested using the power of a spreadsheet. The planner can more easily accommodate 'what if' questions from the community or other organizations in evaluating many possible scenarios.
- Information storage and retrieval – Spreadsheet packages perform well in simply storing and retrieving data (using external storage disks). The integrated packages enhance this capability.
- Budget control – Spreadsheets are ideal for this task. Departmental and projects budgets may be designed on the spreadsheet and then tested for various assumptions. The selected budget can then be monitored to actual performance at various stages during the fiscal year. Multi-year budgets may be established, monitored and annually revised to accommodate changed financial considerations.
- Estimating costs – Unit costs can be applied to different configurations of buildings or structures to evaluate their desirability. For example, manipulation of cost data can be used to compare costs of rehabilitation versus new construction.
- Survey analysis – A spreadsheet can be conveniently used to store and analyse survey information obtained on various studies. Most survey data will lend itself to numerical manipulation where a spreadsheet can be of great value.

There can be other applications. The use is only limited by one's imagination. Any problem where numbers have to be manipulated or where relationships between variables can be established is most likely to be solved using a spreadsheet.

A spreadsheet is one of the most common programs available for microcomputers. The choice will be made primarily on the type of computer one has and its capacity. There are two basic differences between available programs:

1. Whether it is a single program or an integrated one.
2. The size of matrix it is able to handle.

For various types of spreadsheet programs please refer to the software directory.

Word Processing

This is one of the most common and rapidly growing applications of computers in planning departments. In fact, for many planning departments this is their first or the only use of computers.

Word processors are nothing but computers (usually microcomputers) used for processing (editing, sorting, spelling verification, text organization, etc.) words and text rather than data. This is really a superior and more sophisticated alternative to typing.

There are generally three typical word processing alternatives:

- Using a mini or a mainframe with programs such as SCRIPTSIT. This alternative is very convenient and useful to organize large documents as well as a straightforward method of type setting documents.
- Using a microcomputer. This method requires a purchase of an appropriate word processing package (such as WORDSTAR) from the dealer. Although word processing is not convenient, since the user must learn all the extra commands required, the main advantage is that the same computer can be used for both word and data processing.
- Using a dedicated word processor. A number of such word processors are marketed by Xerox, Wang, Micom, AES and others which are microcomputers specially set up for word processing. In these computers many functions such as communications, printing and organizing files, etc. which are usually part of an operating system are actually built into the system. Therfore, a dedicated word processor is relatively much easier to use.

Because of the versatility and power of computers to process text a word processor can effectively be used for a variety of tasks in the planning department rather than just as an alternative to normal typing requirements. The main strength of a word processor is its ability to call in large amounts of written text previously stored, and manipulate that text as desired. Because of these characteristics, many planning applications requiring access or alteration to stored text can effectively be undertaken.

Some of the most common planning applications that can be assisted by using a word processor are:

- Staff reports – Staff reports to council or senior management can be speeded up for quick action. Since all the required changes can be made in a very short time, reports to the council can be made ready at very short notice - thereby facilitating the decision making process.
- Official plans, zoning by-laws, council minutes – These are important reference documents for any planning department and need to be constantly updated. A word processor can be used to store and update this information. It is also possible to use sophisticated word processing programs to search and display text segments using key words or phrases. This ability can be used to its maximum potential by interfacing information between official plans, zoning bylaws and council minutes. For example, it would be possible to search and display exactly when a certain policy matter came before the council and what decision was undertaken. Similarly it would be easy to pull out all the zoning amendments on a certain type of land use or in a certain area of municipality by using key identifying words.
- General correspondence – A word processor can be used to merge standard or form letters and addresses thus saving on secretarial time as well as providing a personalized letter to each individual. Some word processors can print labels for mass mailing.
- Miscellaneous – The power of word processors can be further enhanced by integrating with the other software such as a spreadsheet package or a database. Similarly, a word processor can be linked to communicate with other computers exchanging files and merging information from other sources to in-house information. These advanced applications depend, of course, upon both technological and organizational compatability between microcomputers.

Database Packages

Database packages allow a planner to collect, manipulate, sort, edit or search desired data in a variety of ways. Thus, these programs can replace virtually all manual filing systems. More sophisticated packages are termed relational databases and are capable of creating new files based on a criterion search through a larger file.

A database generally has three components. They are: field, record and file.

A field or an element is one piece of information such as name of a person or property address. Record includes all information about one entity such as name, age, occupation, etc. of a person. A file is simply a collection of all the records on a subject – for example, a property file would contain details of all properties within a municipality. A database system can have many different files at the same time which can be interconnected.

The three basic characteristics of a database are:

- Information is related. Information in various parts must relate to each other to be useful.
- Information is collected in a predetermined manner to serve an intended use or uses.
- Information is structured, that is, the organization of information depends upon key words or a known method so it makes it easier to locate or change any data element in the system.

The use of a computer for establishing a planning database can be extremely useful. Care must be taken in the organization of a database so that information collected can be used to its maximum advantage.

Database programs are of three types: file handler, relational, and procedural.

File handler database enables a planner to replace virtually all manual filing systems and simplify data manipulation. For example, if a planner wants to keep a basic record of mailing lists, bibliography or a simple inventory (for example, vacant industrial lands), then a file handling database would be sufficient.

If an application requires more sophisticated use, such as elaborate sorting, mathematical operations, continual updating or restructuring a database, then a relational database would be needed.

A relational database gives the user the power to manipulate data as one desires. However, the user must learn specific commands or use simple programming to do the required manipulation. Since the user can define the specific type of manipulation, the database can be much more flexible (it does not have to be rigidly structured) compared to a file handler type.

Finally, there are procedural databases which accept logical statements – "do this if that, etc.", whereas, a non-procedural database accepts only global commands such as "list", "copy", etc. Some databases are a combination of both relational and procedural types.

Some of the most common applications of databases for planners are:

- File maintenance – Various files such as all the enquiries or requests for re-zoning, building permits, or their administrative matters can be created in a database and referenced later using key words.

- Inventories – Office equipment and materials, land uses, etc. can be logged with proper classifications, and updated regularly using this type of database.
- Information base – Information normally maintained by planning departments such as socio-economic data, data on land uses, traffic data, environmental data, property data, etc. can all be efficiently handled with regular updates using a database management system. Historical information of this type can easily be accessed, examined and compared with existing conditions in an easy and organized manner.

  Since data collection and updating is a rather time consuming exercise, database systems should be incrementally developed with frequently used data to be included first.
- Issue analysis – This activity is most common to planners. Quite often a planner has to identify, assess and balance the need of an individual (such as a developer) to a community at large. Database management systems can be used to record and analyse large amounts of information to balance out conflicting needs.
- General – Mailing lists, personnel records and financial control can easily be handled using database management programs. Budget reports can be interfaced with other financial analysis using a spreadsheet or similar program.

Communications packages

Communications require a certain hardware and software combination which allows a computer to communicate with another computer(s), including large databases in government and commercial bureaus. Through a communication package, a microcomputer or terminal can be used to retrieve data directly from a larger system, such as of a municipality, university, or Statistics Canada's CANSIM System. Commercial databases such as CompuServe, The Source and Dialog can also be accessed.

If a planner wants to use a microcomputer as a terminal to a larger computer or simply connect to another microcomputer, a communication package will be required. There are two types of communication packages:

- File transfer packages – These packages allow a microcomputer to behave like a terminal to a larger computer. Files from the secondary storage (disks) of a microcomputer can be transferred to a larger computer without human intervention. This is called uploading of files. Similarly, files from larger machines can be downloaded to micro. These packages are also called "smart" terminal packages.
- Simple communications packages – These packages allow a microcomputer to be used as a terminal to a larger computer. This type of package enables a micro to "talk" to a larger computer but cannot be used to transfer files from one storage to another. This is also called a "dumb" terminal package.

The fact that computers and telecommunications can be combined has opened up new possibilities for planners.

Planning is an information intensive profession. Planners consume a large amount of information and data created by others. The ability to connect to other computers and large databases can save a planner the time spent in accessing the information by other (often slow) means.

Major areas where communication can be of particular help include information on utilities, encyclopedic databases, news, specialized business information databases, etc.

Some of the databases which can be connected to are: "The Source", "CompuServe", "DIALOG", "ORBIT", "INFO-GLOBE".

Another area where telecommunication is having a major impact is the ability to interlink various offices in one or two buildings. As opposed to a remote network, this is called Local Area Networks (or LAN). Information between various departments and offices can be be freely shared thus opening up many new and excellent opportunities to planners. Planners can access up-to-date information from other departments when needed. This development is still in its infancy. However, the potential for this type of application is considerable, especially as office automation is also revolutionizing the way people work and do business.

There are both hardware and software considerations in setting up communications. For example, questions of parity, types of modems, baud rate, type of access, etc. must be resolved. It is not possible to go into details of these matters here.

The major planning area to benefit from telecommunication seems to be research. The ability to retrieve abstracts, articles, bibliographies can allow a planner to do more indepth research than at present due to time and geographic constraints.

Communications can also be used to help create a network of planning agencies exchanging data and ideas over the phone lines.

Similarly, the ability to upload and download files can save an enormous amount of time spent keying information into the system.

Integrated packages

Integrated software is a relatively new concept. However, for a planner it is of special interest and value.

Integrated packages contain a variety of functions within one software package. The advantage of integrated packages is ease of use. The user can move back and forth between the systems functions very easily. Without an integrated package, the user is required to store data or even retype information for each software package used. Integrated packages overcome this inconvenience.

There are two types of integrated software:

- Integration within one application. For example, many word processing packages offer integrated options. In these packages, various word processing functions such as text editing, spelling correction, mail merging functions, etc. can be provided in one package.
- The second type combines different applications into one single package. Up to five components have been incorporated in one commercial package: spreadsheet, data base, graphics, word processing and communication. Information can be taken from one package and inserted into another without keying in or change of programs. For example, information from a spreadsheet or a graphics package can be taken and processed by the word processing package.

Integrated software is gaining in popularity. Many firms are now offering various interlinked programs that fit together. It enables the user to perform previously impossible or difficult jobs with great ease.

These programs also enable a user to call data from different applications such as spreadsheet and graphics at the same time on to a monitor or screen. This feature to provide windows from different programs on one screen at the same time can be extremely useful to the planner in terms of time saving.

GUIDELINES ON USING COMPUTERS FOR SPECIFIC PLANNING TASKS

This section will provide a methodology for selecting appropriate software programs from the software directory to carry out specific planning tasks as defined. If a satisfactory commercial program is not available the reader is encouraged to investigate non-commercial packages, or think about custom-made programming if it is an important enough application.

Applications software is created for a single purpose. In general, this purpose involves modelling some form of technical analysis, such as retail demand or economic analysis. Applications programs may be applicable to a number of businesses or professions, as is the case with a project management program, or they may be useful only to those working in selected fields, as are land use modelling programs. Many applications programs are written by persons working in that field, as opposed to a professional programmer, and so may not be simple to use or produce output that is similar to a professionally produced program. Nonetheless, regardless of their origin, if their specific features match technical requirements, they can be a valuable analytical tool. The categories of application-oriented programs or models contained in this report are:

- Word processing
- Statistical analysis
- Spreadsheet
- Database management
- Communications
- Graphics/CAD
- Mapping
- Integrated
- Land use planning
- Transportation
- Mailing lists
- Retail modelling
- Project management
- Geographic system
- Fiscal/Financial
- Miscellaneous

SELECTION PROCEDURE FOR SOFTWARE

This section describes how a planner should decide which general application or specific application program he/she should obtain for the task at hand.

- The procedure suggested here involves three basic steps:

- Definition of the task at hand
- Identification of general or specific application software category
- Selection from programs or packages listed under each category in the software directory.

TASK DEFINITION

Planners undertake a variety of tasks in their day-to-day activities. These tasks are of three main categories:

- Production – doing the planning, processing applications for development approval,
- Management and administration – staff and project schedules, budgets, records,
- Information resource – gathering, storing and retrieving municipal information.

For each of these primary planning functions, typical tasks involved in carrying out the function are listed below.

The information on Charts 1, 2 and 3 provides a general appreciation of the extensive potential for computer applications in planning.

Production

This part of a planning agency's responsibility includes all tasks directly related to producing plans, studies, reports, maps, etc., and to processing the applications for development. The breakdown of tasks listed below and on Chart 1 represents typical activities a planner engages in and where computer programs can assist.

It should be noted that the following planning tasks are not listed in the order of any priority. Some of these tasks such as text handling, trend analysis or forecasting are relatively easy to computerize and the payoff is generally high compared to some other tasks requiring a high level of commitment and expertise such as digital mapping or project control and management.

- Project control and management – The management of each planning project undertaken by an agency is an on-going function, and includes scheduling tasks, manpower allocation, budgets for each project by task and cost recording. These functions have been computerized in many businesses and government agencies using custom-made software.

More recently, general purpose computer packages and several specific applications packages have been used for this task. The use of a computer in this task is invariably not justified or necessary in the case of a small planning department since control and management of workload can be achieved quite effectively without using computers.

- Data handling – Data on socio-economic characteristics of the community, environmental features, land use, properties and infrastructures are used in most planning activities. Collecting, storing and retrieving that data in a convenient form can be assisted with computer systems. Many municipalities are currently storing and manipulating data which planners can use in their work. As well, larger commercial and governmental databases can provide much of the information needed for planning studies.

Typical activities involved in data handling are:

- Accessing data in the municipal database including property records,
- Retrieving Statistics Canada data from the CANSIM system,
- Retrieving data from commercial data banks, particularly bibliographies,
- Recording, sorting and manipulating survey data, such as housing, land use, retail space, employment, population recreation facilities, environmental features, traffic, parking,
- Graphics output of stored data through a printer or plotter,
- Data analysis on stored information including statistical analysis of survey results,
- Development application management whereby the characteristics and status of current development applications are recorded and available for analysis. Year-end reports on development activity could also be prepared.

- Trend analysis and forecasting – Most planning studies extrapolate today's conditions into the future, using some form of algorithm (straight line trend, rate of growth, regression curve fit, mathematical formulas, etc.). The algorithm is a mathematical model which relates today's environment, as represented by a dataset, to the expected future condition. Some are simple, others more complex with numerous variables and coefficients such as used in transportation models.

  Applications programs can be of two general types. The first group are the single-purpose programs, usually complex and written for mainframes. Transportation models and retail gravity models are examples. The second group are 'templates' for the spreadsheet or integrated general purpose packages which contain the appropriate mathematical relationships and a data input format. These templates 'customize' the general purpose software for a specific application. To date, planning templates are not commercially available but have

CHART 1: **PRODUCTION FUNCTION**

PLANNING ACTIVITIES / **COMPUTER PACKAGES**	WORD PROCESSING	STATISTICAL ANALYSIS	SPREADSHEET	DATA BASE MANAGEMENT	COMMUNICATIONS	GRAPHICS • CAD	MAPPING	INTEGRATED	LAND USE PLANNING	TRANSPORTATION	MAILING LIST	RETAIL MODELLING	PROJECT MANAGEMENT	GEOGRAPHIC SYSTEM	FISCAL • FINANCIAL
PROJECT CONTROL • MANAGEMENT			■					■							
DATA HANDLING				■	■	■		■					■	■	
TRENDS ANALYSIS AND FORECASTING		■	■			■		■	■	■		■			
ANALYSIS • ISSUE IDENTIFICATION		■	■	■				■	■	■		■		■	■
ASSESSMENT • EVALUATION OF ALTERNATIVES		■	■			■		■	■	■					
FORMULATION OF POLICIES • STANDARDS • REGULATIONS				■				■	■						
BASE AND ZONE MAPPING						■	■							■	
GRAPHICS						■		■							
TEXT PREPARATION • REVISION	■					■		■							
PUBLIC CONSULTATION • REVIEW • APPROVAL	■			■	■			■							
DEVELOPMENT STATUS REPORTS	■			■				■			■				
LAND USE INVENTORY			■	■	■	■		■						■	
LAND DEMAND ANALYSIS		■	■	■				■	■			■		■	■

been written by practitioners and made available among groups of users.

The flexibility, power and data handling capacity of spreadsheets/integrated programs will likely allow planners to undertake almost all of their modelling and forecasting needs, with the exception of complex transportation systems analysis.

- Analysis and issue identification – The identification of significant issues and factors is usually the output of the analysis phase of planning studies. Such issues might be the need for additional serviced land, need for additional services or facilities, housing stock below a specific quality level, shortage of a resource, etc. In simplistic terms, issue identification involves screening a database on existing or future conditions against a criterion. For example, land requirements against land supply.

  Statistical analysis procedures can be used to analyze datasets for distributions, means and deviations. If a criterion of acceptability was available all samples not meeting that criterion could be extracted. For example, a survey of walking distances to a local park could be analyzed to identify those households with a walking distance 50% greater than average.

- Assessment and evaluation of alternatives/impact analysis – The assessment of alternatives means describing the absolute or relative performance of an alternative against a given factor. Evaluation involves selection among those alternatives based on the relative importance of the factors to the decision maker. There are very sophisticated models for assessment and evaluation. However, very few planning assignments can use such packages due to cost, data requirements and their lack of sensitivity to value variations in decision making. There are components of the broad assessment and evaluation function which do lend themselves to computer applications such as economic and financial analysis of a series of options. Transportation models, accessibility models and retail impact models are also examples of computer packages which can be used to describe the performance of a number of alternatives (roadways, firehall locations, shopping centre locations) against a measure of performance (vehicles per hour, travel time in minutes, trade area retail expenditure).

  Evaluation and selection among alternatives is most commonly performed in a comparative non-quantitative manner, recognizing the difficulty in numerical scoring systems which must reflect public values in a quantitative manner. However, some practitioners use ranking and scoring systems, an approach which can readily be performed with spreadsheet packages as described in previous sections.

  All are characterized by one feature – they enable the user to quickly assess change in performance of an alternative given various data assumptions – the "what if" analysis. Having mathematically replicated the problem being analyzed, the planner can test a wide range of alternatives quickly, efficiently and consistently. The range of applications in a planning environment is limited only by the ability of planners to create the mathematical relationships needed to model a situation.

- Formulation of policies, standards and regulations – Preparation of policies, amendments to policies and zoning standards is a non-quantitative task. The use of computer systems in this area is therefore limited. Word processing packages can be used for preparing and revising draft policies. Database management systems could also be used for a reference file system on policies and by-laws for a specific topic. For example, a reference code for policy keywords (aggregates, environmentally sensitive areas, open space) could be used in a database system, in order to be able to call up particular groups of data. Such a system might prove useful for planning agencies who have the responsibility of reviewing planning documents (Province, Regions) whereby all policies on a given topic could be extracted from the database and reviewed.

  Monitoring of policies and regulations can also be assisted using computers by creating appropriate files of monitoring data and its subsequent analysis.

- Base and zone mapping – The most distinctive feature of planning practice is the extensive use of maps to convey ideas, display spatial data and define geographic areas which will be subject to certain regulations. The use of computers for these tasks is in its infancy – high cost for equipment, the need for skilled operators and the low volume of mapping undertaken in most planning agencies all weigh against the widespread acceptance of large CAD systems in planning practice. That situation is changing due to two recent developments:

- The availability of digitized base map information on tape for many municipalities enabling users to contract with service bureaus who have large CAD systems. In these situations, a user can have customized mapping prepared on the municipal base mapping system.

- The development of microcomputer CAD systems which are within the financial means of most municipal planning agencies. While lacking in the speed, capacity and sophistication of the large CAD systems, there is a possible role for microcomputer CAD systems in planning functions where precision of output is not as critical as it is for machine design. Creating thematic maps for a rural area (for example - soils, environmental features), updating zoning maps and conducting urban design studies are examples of potential applications.

  Mapping and graphics with a microcomputer system does require relatively costly hardware, including digitizers and plotters capable of reproducing large format drawings. A more detailed discussion of these hardware requirements is presented later in Part 4.

- Graphics – Business charts and graphs which are representations of numeric data in the various types of graphic output (such as bar charts, line graphs, pie charts, etc.) are widely used by planners in their reports, display or visual presentations.

  Graphics can be produced on microcomputers. All that is needed by the user is an appropriate graphics package, database package and a printer. Using a pen plotter the user is able to produce high quality colour graphs and transparencies.

- Text preparation, revision and refinement – Word processing packages have an obvious role in the planning office – often more so than in many municipal departments. The very nature of the planning process implies revisions, refinements and amendments to documents, often over a period of years. Word processing programs can eliminate much of the repetitive effort required to revise documents manually and to print documents for which a number of copies are needed. Also, reports often contain numeric data in tables, graphs and charts. A word processing system, which can incorporate such report components into the text by retrieving data from a database, spreadsheet or graphics package, are particularly suitable.

- Public consultation, review and approval – Notices of meetings, direct mailouts, surveys of neighbours, etc. are part of the planning process. For planning projects which will require a series of mailings, the use of a mailing list software package could be more efficient. Coupled with a word processor, letters and notices can be sent directly to people or groups on the mailing list.

  The results from public consultation and review exercise can easily be incorporated into policies and documents.

- Development status reports - Periodically, these reports will be required by the council when considering development applications. If the necessary information is kept in a database system, it can be accessed to produce the desired information. A word processing package or an integrated package will also be required in conjunction with the database to produce reports with text, data and accompanying graphs.

- Land use/housing/commercial/industrial inventory – Keeping and updating various inventories of land use in a computer is relatively involved but potentially very beneficial to the planner, especially if there are rapid changes occurring in the municipality.

  To create inventories of various land uses a geographic reference base will have to be created. This would allow retrieval of inventory data on any set of geographic co-ordinates. However, if the area cannot be digitized due to lack of resources, inventories can still be kept on the basis of fixed planning districts, traffic zones or any other zonal system using a database, spreadsheet, communication or an integrated package.

- Land demand analysis – A planner is usually called upon to estimate land requirements for various land uses. Without doing a proper analysis there is a danger to overestimate or underestimate these requirements. An understanding of standards for industrial and residential land requirements related to population size and time sequence aspects of residential, commercial and industrial uses is necessary to make proper estimates.

Management and administration

Management of the planning agency's responsibilities includes scheduling a group of projects, budget preparation and control, project and personnel records, library, central files and year-end reports.

The management of a planning office offers a significant opportunity for increased efficiency through computerization. Chart 2 indicates the opportunities for applying certain computer packages to the management and administration of the planning department.

- Work scheduling/manpower allocation – Each project which the department is working on

CHART 2: **MANAGEMENT AND ADMINISTRATION**

PLANNING ACTIVITIES / **COMPUTER PACKAGES**	WORD PROCESSING	STATISTICAL ANALYSIS	SPREADSHEET	DATA BASE MANAGEMENT	COMMUNICATIONS	INTEGRATED	MAILING LIST	PROJECT MANAGEMENT
WORK SCHEDULING • MANPOWER ALLOCATION		■	■			■		■
BUDGET PREPARATION AND CONTROL			■			■		
GENERAL RECORDS • LIBRARY • DEPARTMENTAL	■		■	■	■	■	■	

CHART 3: **INFORMATION RESOURCE**

PLANNING ACTIVITIES / **COMPUTER PACKAGES**	STATISTICAL ANALYSIS	SPREADSHEET	DATA BASE MANAGEMENT	COMMUNICATIONS	GRAPHICS • CAD	MAPPING	INTEGRATED	RETAIL MODELLING
DATA COLLECTION • RECORDING • STORING			■	■	■		■	
DATA ANALYSIS • TRENDS • FORECASTS	■	■					■	■
INVENTORIES • SURVEYS	■		■	■	■	■		

becomes a task in the project scheduling program, with associated deadlines and manpower. By allocating staff resources to these projects and using the capability of the software to "level" the use of resources to a given constraint (for example – the number of work days available), the projects of the department could be scheduled so that manpower is efficiently used and bottlenecks avoided. Thus, the allocation of person-days to each project for a given period can be quickly adjusted and balanced.

- Budget preparation and control – The preparation and monitoring of departmental budgets is one of the primary applications. Available software systems could be readily adapted to the specific needs of a planning department. Monthly monitoring of the budget would simply involve entering actual expenditures and computing overs and unders, enabling the manager to quickly re-allocate resources to achieve the agency's overall objectives.
- General records, library and departmental reports – The central records of a planning office, including files, reports and library materials need to be organized and stored in a manner which facilitates quick access and retrieval. Database management systems are an ideal tool for record indexing and retrieval. For each report prepared, a brief keyword index could be created, allowing for a keyword search in future for all reports, applications, etc., on a given subject. Library materials can be similarly indexed. An additional application is to use a communication link to a commercial data bank containing an electronic bibliography. 'Dialog' and other large databanks have extensive libraries including many subjects of interest to urban, regional and environmental planners. Computerization of this task will only be justified if the planning department is relatively large, and where automation will actually save time compared to manual search.

Information resource

A function related to both the production and management areas just discussed is the information resource role of the planning agency. The general and comprehensive nature of planning makes this function a natural component of the agency's overall mandate. Chart 3 indicates some of the tasks involved in this information resource function and the associated computer programs to assist in that function.

- Data collection, recording and storing – This is a major source of planning agency activity – providing information to other departments and the public. In some large departments, a research group's major function is the development and dissemination of information on the urban area or region. Database management systems, graphics and CAD, and communications with other computers were discussed earlier. The same systems are appropriate for this planning function. Communications with the users' computer system would be an additional asset.
- Data analysis, trends and forecasts – These are the analytical functions associated with stored data and with the overall growth/development conditions of the planning area. Annual population and employment forecasts, housing demand and analysis and other up-to-date forecasts are prepared by a number of municipalities for use beyond their own project responsibilities.
- Inventories/surveys – As well as storing data and analyzing it, planning agencies are often responsible for undertaking surveys and preparing inventories on features of the area, such as housing, recreation, land use, offices, etc. Surveys and inventories can be efficiently stored and analyzed using the database systems discussed. When linked to a graphics system, mapped output can be provided.

IDENTIFICATION OF SOFTWARE CATEGORY

The above discussion provides a broad discussion of various individual tasks a planner would undertake. The tasks are not mutually exclusive and there could be considerable overlap. Once a planning task is selected, it can be correlated to individual general purpose and specific application computer program categories using Charts 1, 2 and 3.

SELECTION OF PROGRAMS FROM THE DIRECTORY

The software directory lists individual programs available under the general purpose and special application categories defined earlier. The user can choose from these programs taking into consideration the factors which include hardware requirements, operating environment, price, support, etc. The directory also provides a brief description of each package. It is not possible in this report to describe in detail how each task can be carried out using the package(s) identified. Full details can be obtained by contacting the producers of these packages. It is also useful to contact any users to get an understanding of any problems, specific requirements or the degree of user friendliness.

HARDWARE SELECTION

If appropriate decisions are not made in the selection of hardware, and hardware is not used as intended, there could be created a climate of frustration which could prove detrimental for any future gains that would have accrued from an efficient use of computers.

The question of what hardware is needed will depend on many factors, most important of which will be whether or not it can run the software selected and provide ancillary services to enable planners to carry out desired tasks. The municipality would need to decide whether the equipment being considered for purchase should be bought outright, rented or leased. Questions regarding compatability with any existing equipment, future expansion, etc. will have to be addressed.

The various issues and questions regarding purchase of hardware are not being addressed in this report. The reader is directed to the Ministry publications where these matters have been covered in detail. The publications are listed in Appendix 6.

Since planning departments are not generally at the centre of decision making process regarding hardware purchase, especially if a particular system is being developed for the corporation, it can be argued that the planning department should make use of corporate facilities. In this case, the strategy would be to find the best fit between available corporate resources of hardware and the needs of the planning department.

The dependence of the planning department on central computer facilities is decreasing rapidly especially due to the availability of cheaper and powerful microcomputers. In due course, it is expected that planning departments will be able to satisfy most of their data processing, word processing and mapping requirements using independent computers.

A major thrust of this report is to prepare planners for this change and provide them with guidelines and necessary assistance to use microcomputers in their workplace. The next chapter of this report deals exclusively with the use of microcomputers in planning. Hopefully, this report will open up the potential that such computers have for planning applications.

A brief discussion of various hardware configurations that typically exist in planning departments is presented here. It is intended to provide a general overview of the hardware environment a planning office can expect to have at the present time.

TYPICAL HARDWARE CONFIGURATIONS

The computer hardware present in a planning office will vary depending on the size of the community it serves, the functions to be performed, the volume of work and so on.

One of the most common hardware configurations is that of a terminal connected to a mainframe computer, which can belong to either the municipality, another government agency, a local university or other agency with whom a service bureau type of arrangement has been made. The most common link is between a departmental terminal and the municipality's mainframe. Several communities can link into university or service bureau mainframes in addition to their municipality's computer. Files can be downloaded to the micro and altered without incurring mainframe processing costs. Also, larger programs may be run and larger databases may be manipulated using the mainframe system. Such a configuration also permits access to a number of computers, and hence to a variety of data bases and program libraries.

Another hardware configuration consists of a minicomputer, either in the planning department, or connected to the department via a terminal. Systems of this type are in use in several cities.

A third configuration is the isolated microcomputer. The number of municipalities using microcomputers increased from 2 in 1981 to 21 in the recent survey. A few have hard disks for added capacity, and several have printers and/or plotters (of varying sophistication).

Another common practice with municipalities is to have word processing systems independent of analytical computing equipment. Some of these systems can operate under the popular microcomputer operating system CP/M. These word processors can thus be used as microcomputers, as well as serving their intended functions. The effectiveness of such a configuration will depend on the amount of time available for work other than word processing.

Equipment that is almost always available somewhere for all of these computer configurations is a printer, and possibly a plotter as well. The type of device will vary depending on the quality and speed of output required. Dot-matrix printers are the norm for internal office communications, while daisy wheel, ink-jet or laser printers can produce letter-quality type and graphics. Plotters are produced with a wide variety of features and abilities, but are usually only employed for projects using larger scale mapping.

To summarize, hardware configurations range from micros with very limited memory, through minis to mainframe terminals. Microcomputers are becoming more widely used, since their combination of variety of features and accessible price range are becoming more attractive to planners and other professionals. The increasing range of computing capacities being produced at the present time should allow the selection of an appropriate system for almost any combination of budget and computing needs.

[redacted]

PART 4
SELECTING AND USING A MICROCOMPUTER SYSTEM

Before discussing the process of selection it is necessary to understand the main components of a microcomputer system and their basic functions.

A microcomputer system consists of a personal desktop computer and its associated devices. The electronic circuitry in a microcomputer is very compact. Very Large Scale Integration (V.L.S.I.) techniques are primarily responsible in bringing down the size and cost of computers.

BRIEF INTRODUCTION TO MICROCOMPUTERS

HARDWARE

The machine itself and all the devices attached to it are termed as computer hardware. The main machine consists of a Central Processing Unit (CPU), main memory and all the input and output devices, such as keyboard, disk drives, Visual Display Terminal (V.D.T.), and printer and/or plotter. The screen may be attached to the CPU in the same cabinet rather than being physically separate devices.

Input devices provide a method of entering information into the computer. The keyboard is the most common device. Other devices such as disk drives, light pens, optical scanners, a mouse (mostly used in graphics) or joy sticks (used in games) are also available. More recently, devices that will transform human voice for machine use are being developed.

Output devices enable a computer to present the results in an understandable form. The two most common output devices are printers and display screens. A display screen is a TV-like screen which is also known as a VDT (Visual Display Terminal), CRT (Cathode Ray Tube) or monitor. A TV screen itself can be used as an output device with many microcomputers. Plotters which are used for graphic and mapping output are also available.

Display screens can be high resolution (use of more dots) or low resolution, colour display or mono-chrome. High resolution colour screens are more suitable for graphics and games since they provide a more accurate output.

Printers are usually classified by their speed and whether they are impact or laser-jet types. The speed can be measured in lines per second or characters per second.

Dot matrix printers (an impact type) form characters using dots. The output quality varies with the number of dots per character.

Daisywheel printers produce copies similar to typewritten quality. These printers can only print one character at a time and are therefore slower. Good letter quality printers are more expensive than dot matrix printers. The cost is still higher for high speed printers.

Computer memory is a collection of semiconductor devices which can store information in binary digits. Binary digits (or bits) are grouped together to represent characters or numbers. Each such group is stored and retrieved by the computer using a unique address.

Main memory consists of Read Only Memory (ROM) or Random Access Memory (RAM). ROM is permanent type of memory and contains a program supplied by the manufacturer. This software cannot be changed except by replacing the ROM chip itself. ROM software is also called machine software or firmware and is required for the internal operations within the computer itself (fetching and releasing information to input/output devices, moving data within the computer, and providing interaction between various parts).

Random Access Memory (RAM) is used to hold programs and data on a temporary basis when the computer is working on them. The contents of RAM are lost if the power is switched off. It is also called volatile memory. Portable operating systems (CP/M, MS-DOS) are also loaded into RAM along with the application program being executed.

The total quantity of memory (ROM and RAM) in a computer is its capacity. Computer capacities are measured in kilo bytes (or K bytes). A byte is a group of 8 bits. One kilo byte is 2^{10} bytes or 1024 bytes. The greater the number of bytes that can be stored in a computer the more powerful it is considered as it can run larger and more complex programs.

External storage, secondary storage or mass storage for a microcomputer is also expressed in kilo bytes of memory. It is used for storing programs and data outside the computer. Since an internal or main memory of a computer is usually much smaller, most of the data must stay outside the computer and be brought in when needed for processing.

Secondary storage can be on floppy diskettes, cassettes or hard disks.

Floppy disks are the most common means of external storage. They come in 5 1/4" and 8" sizes. Some micros (Macintosh and HP150) use 3 1/4" size diskettes. Floppy disks are low cost, portable and provide speedy access of data to the computer. The amount of information that can be stored on a disk depends on its size and whether it is a single, double or quad density disk. A 5 1/4" disk can hold anywhere from 140K to 950K bytes. An 8" double sided double density disk can hold 1.2 million bytes.

Cassettes are an inexpensive alternative to disks. However, they are much slower and relatively unreliable. Cassettes are not suitable for business or office use.

Hard disks are rigid, have much larger capacities and are relatively expensive. Hard disks provide fast access and therefore are most suitable where speed and large volume of data are the major factors in operation. The capacity of a hard disk ranges from 2.5 megabytes and up. They usually come encased in their own disk drive and cannot be removed or interchanged like floppy disks. Removable hard discs are also available on the market.

The Central Processing Unit is also called a processor. In microcomputers the processor is a single silicon micro chip. Some people call it the brain of the computer since it performs all the arithmetic and logic operations on programs and data, and interacts with all the other parts (memory, input/output units) of the computer.

Without going into details it would be sufficient to point out here that a processor has most complex circuitry, encompassing four different components within it. These components are: Registers, Arithmetic and Logic Unit (A.U), Control Processing Unit (CPU) and an internal bus system for data transfer in and out of the CPU. Different microcomputers use different micro processors. For example, Apple uses 6502 of MOS technology, IBM PC uses Intel's 8088 and Radio Shack TRS80 uses Texas Instruments' 6809. Zilog, Motorola and Digital Research also manufacture micro processors.

The processor primarily determines what type of computer you have: whether it is an 8 bit or 16 bit machine and what programs can be run. Thirty-two bit processors for microcomputers are now on the market.

SOFTWARE

Software refers to data and instructions (programs) given to the computer for execution. Without instructions that the machine can 'understand', no processing can take place. Common to every microcomputer are certain facilities that are necessary for the successful execution of programs and data:

- When a microcomputer is turned on it should be able to make a few basic checks. For example, it may check if there is a disk in the disk drive to be read, if the screen is clear, if the printer is connected, etc. To accomplish this a small program called bootstrap is written in ROM. The whole purpose of this program is to get a computer started and ready to receive further instructions.
- The next step is usually to load a program called a disk operating system (PC DOS for IBM computer). Once this program is loaded, a computer is ready to interact with the user and control various parts of the hardware. For example, the user can load a program written in the same operating system from disk, or via keyboard, enter data, get a print out of what is in the memory, transfer programs and data from disk to memory and vice versa. In computers where a disk drive is not used, an operating system is still necessary to control various operations and interact with the user.

  Companies producing microcomputers have developed their own proprietary operating systems. These operating systems are mostly machine specific and cannot be used on any other machine. However, some operating systems are portable and can be used on different machines using the same processor. MS DOS and CP/M are the most common operating systems for microcomputers. More recently, new types of programs called EMULATORS have come on the market. These programs can emulate one machine into a different one (requiring a different operating system). For example, an emulator program can turn an IBM PC into an Apple II which means that programs written for

Apple II can now be run on the IBM PC. In future, 32 bit microcomputers will undoubtedly become more popular. The most common operating system for such computers is likely to be a version of UNIX. (See glossary)

- Since execution of a program in the machine can only take place in the machine language (in binary instructions of O's and 1's), it is necessary to have a program to translate high level instructions to machine instructions (or code) before execution. These programs are called assemblers, interpreters and compilers. The difference is that the interpreter program translates one instruction at a time and after it is executed takes the second instruction. On the other hand, a compiler program translates the entire program before execution. Whether an interpreter or a compiler is needed depends upon the language of the application program. BASIC for example, is an interpreter language whereas FORTRAN is a compiler language. A compiler program produces faster execution. Assemblers translate low level assembly language program into machine code instructions.
- A user also needs a facility to edit or make changes to the programs he/she is using. Every micro comes with an editor program. This program manages the display on the screen and enables the operator to make appropriate changes. Editors can be line editors, which means the user can only edit one line at a time, or full screen editors which means a user can move data on a full screen. Sophisticated full screen editor programs can also be used as word processors or text processors.
- Finally, a user needs an application program to solve the problem at hand. The purpose of hardware and all other programs is to execute the user's application programs. Application programs for planners and how they can use them is a primary focus of this publication. Software overview and how to select appropriate planning software is discussed in detail in Parts 2 and 3.

BASIC CONSIDERATIONS IN THE SELECTION OF A SUITABLE MICROCOMPUTER SYSTEM

There are three basic considerations in the traditional selection of a suitable microcomputer system:

- An analysis of one's computing needs is done in order to focus the requirements for the proposed system.
- Existing software is examined to determine if there are programs available to perform the desired functions (and what the hardware requirements are).
- The hardware system is selected.

This section describes the considerations involved in these procedures, together with some discussion of the future of hardware and software for micros.

NEEDS ANALYSIS

The analysis of the need for a computer system determines the answers to the following basic questions:

- Is a computer required?
- For what tasks?
- What type of computer system is required?

To answer these questions, one defines the activities of the planning department, and the processes and resources used to accomplish them. By performing the following tasks, it should be possible to determine what functions could be improved by computerization and what general system capacity is required.

Task 1: Survey of potential computer users

Determine for them:

- Possible areas of work streamlining,
- Opportunities to improve the quality of analysis undertaken,
- The perception of the agency's existing capacity to assemble, analyze and manipulate data,
- Operations that are perceived to be excessively time-consuming, and which could be automated.

Task 2: Description of agency functions

Part 3 describes the typical tasks of a planning agency which could benefit from computerization. Tasks that fall into those categories should be analyzed in detail in terms of inputs and outputs and the time and processes involved. A regularly occurring task (such as word processing) should also be analyzed. The assessment of opportunities for computer applications should involve the following:

- Outline the existing procedure used to perform the function, in terms of inputs, outputs and processes,
- Determine the cost (in time, labour, etc.) to perform each function,
- Summarize the strengths and weaknesses of the existing procedure,
- Compare the procedures for each function (are they the same at the basic level of operation?).

Task 3: Investigation of shared-use computing

If there is a computer available in another department, at local universities or government agencies, and it is available for use on a shared basis, determine:

- The type of computer system (mainframe/mini/micro),
- Conditions and costs of use,
- Time and computing resources (software, hardware) available,
- Availability and costs of hardware required to link into the system,
- Availability and costs of software for the system.

Task 4: Consultation with other planning professionals

Planning professionals in other agencies should be consulted as to their experience with computers. Specifically, from those who have employed computers, one should determine:

- Hardware type and cost,
- Secondary costs – software, maintenance, etc.,
- Computer functions,
- What was involved in implementation,
- Benefits obtained,
- Size of operations computerized, in terms of data volumes,
- Level of satisfaction and advice to novices.

Task 5: Consultation with planning and computing consulting firms

Planning consulting firms could be contacted to determine if they employ computers and if so in what capacity.

Task 6: Consultation with other sources

Other sources to consult for information include retail computer suppliers, books, periodicals and journals, and organizations such as the Roads and Transportation Association of Canada and the American Planning Association.

SOFTWARE SELECTION

General purpose and application programs

If the needs analysis demonstrates that a computer is needed, the second step in the process is the selection of software. Software, since it is more critical than hardware should be chosen initially. For many planning functions, off-the-shelf software will provide an adequate array of features (see the software directory for listings and programs).

Custom-made software will provide for needs more precisely, but at a much greater cost. The best overall course to take in acquiring software is to begin with ready-made packages, and then as computing expertise increases, to begin developing software.

Initially, factors to consider in examining existing software should include:

- Documentation: Programs that do not provide adequate documentation can be frustrating, as well as of very little use. Preferably, documentation should include a thorough reference manual, an operations manual, a quick reference card and possibly a tutorial disk. Check the manuals for readability.
- Hardware requirements: Determine what hardware is required to run the program (disk drives, hard disks, amount of memory, printers, colour graphics, adaptors, etc.). Compare hardware requirements for similar programs, and estimate the total cost of alternatives.
- Ease of use: This will be an important factor in determining ultimate satisfaction with the program. It is suggested that a program be tested on a trial basis before purchase to determine if it is easily usable. One feature to consider is the type of command mode: menu-driven programs are easier to learn to use, but command driven programs are better suited to long-term, computer-literate use. Experienced users will soon find that returning to the menu for each new operation is exceedingly time-consuming.
- Input form: The format of input will also affect satisfaction. Input formats should be flexible, and as simple as possible. Avoid programs that require tedious repetition of input.
- Language/operating system: The operating system (MS-DOS, CP/M, Apple DOS) required for a given program may dictate the type of machine purchased. Therefore, choose programs that can all be run on one operating system that is perceived to be viable at present and in future. For in-house programming "BASIC" can be used on most microcomput-

ers. To use other languages, compiler (for example, FORTRAN Compiler) programs will need to be purchased.

- Output options: The most important output option to look for is the ability to produce output on a printer. Without this option, a program is of little use. Good programs offer a choice of output – to screen, printer or storage.
- Support: Dealer support is an important feature if there is difficulty running a program. Buy from a dealer with experience on the program, and who is willing to answer questions. If possible, investigate the reputation of the program producer. Look for programs that include seminars or demonstrations and for which books are available from independent authors.
- Suitability for task: This will be a function of the program's capacity (the number of records, or size of data files it can accommodate, the amount of data that can be processed and the size of fields). Check the capacity with respect to the specific application. Suitability will also depend on output options available and input forms. The type of functions the program performs will be crucial – do they match your requirements?
- Cost: Cost will include purchase price and maintenance fees. Other factors to check include provision for corrections and enhancements, the number of copies provided, the ability to copy the program and provision of source code (to allow in-house changes).
- Compatibility with other software: The most important aspect of compatibility relates to compatibility with the operating system, which has been discussed above. However, compatibility between programs may also be important if you wish to use output from one program as input to another. For example, a data file created by a database management program might be intended for use in a statistical analysis program. The data formats for these programs must be compatible. Your needs in this matter should be thought out before purchase. Where appropriate software exists which 'links' programs, some thought should be given to purchasing an integrated software package which is designed for this purpose (see listings under 'Integrated Packages' in the software directory).
- Experience of other users: If possible, check with other users of a program before purchasing it. Ask the dealer for the names of other purchasers. Questions to ask of other users include:

- How long did implementation take?
- Did the dealer help with use?
- Did they have any problems running it?
- Has it been used at full capacity?

In summary, the most important features to look for in selecting software are the functions of the program, the hardware requirements and the operating system required. This last factor is particularly important, since the operating system chosen will dictate the software used. It is important to buy an operating system that allows for expansion and enhancement.

Computer assisted design (CAD) software

There are additional considerations when the software acquisition involves CAD. CAD originally referred to computer assisted (aided) drafting. CAD (CADD) can now be referred to as computer aided design-drafting, which suggests an interaction between design and drafting functions.

CAD software packages desirably should be assessed against the following factors: database intelligence, functionality, analysis, design, report generation and expandability. It is noted that high performance in all of these categories cannot currently be met by microcomputer software. However, the technology is rapidly advancing and it is therefore appropriate to keep them in mind when evaluating CAD software:

- Database intelligence is the extent to which the computer recognizes graphic entities such as a polygon created by the user from straight lines rather than only the individual lines. It is also the extent to which non-graphic data (such as a label) can be incorporated into a graphic element and either displayed on the graphics monitor or printed in the form of a report. "Associativity" is the term used for linking non-graphic data with graphic elements.
- Functionality refers to the extent to which the software meets the users' needs. The following are important considerations in assessing the functionality of a CAD system:

- The coordinate system must be large enough to provide required precision over the required area,
- The response to commands must not cause extensive waiting,
- It should allow for the creation of standard symbols and storage of these in a library for future use,
- Scaling up or down of input data is necessary,
- Dimensions should change automatically when a drawing is scaled,

- It should be able to separate information on different levels for exclusive display (for example, if a thematic overlay is used on a base map),
- It should accept commands and data entry from graphics input device such as digitizers,
- It should overflow data from memory to storage when drawing limits are exceeded or provide a message to that effect,
- It should have a uniform file set-up for transfer (translation) of data from other software packages,
- It should support several computer makes and peripheral devices,
- It should be able to zoom, pan, obtain status, move, copy, delete (partial/full), merge, produce overlays,
- It should be able to carry out mathematical calculations such as distance, area, etc.
- Analysis and design capabilities of software are important from the standpoint of calculating unknown information about a geometrically defined element or providing the results of an iterative process where a design is modified in stages through the testing of a number of 'what-if' scenarios.
- Report generation capabilities allow the extraction of graphic data from a file and the reformatting and printing of that data as specified by the user. Desirably, the reports should be automatically updated if the graphics data is modified.

Future developments in software

Future developments in software will be dictated largely by the capabilities and limits defined by new hardware developments, and it is adequate to say that the trend in hardware will be towards greater memory capacity. The most obvious software trend is toward the development of more specialized software as developers tap previously untouched markets, and more integrated systems of software programs. As computers are finding a wider range of applications, there is more pressure to have data that is created or used in one program to be usable in other programs. For example, it would be desirable to have data produced by a spreadsheet accepted into a word processing program for incorporation into a report. Integrated systems, such as Lotus 1-2-3, Lotus Symphony, Peach Text 5000 and Lisa/Macintosh Systems (see listings under 'Integrated Packages' in the software directory) are now finding much wider acceptance due to their integrated nature. Thus it is probable that more programs will be absorbed into an integrated format. This may be achieved by translator programs (the least efficient method), or by developing more integrated packages.

However, it is probable that the ultimate means of integration will be the acceptance of a standard operating system across the industry. The move towards a standard operating system is in fact already underway, as a result of the overwhelming success of the IBM-PC, and the operating system DOS. The introduction of the IBM-XT and 3270PC reinforce this trend, as they are intended to be used as terminals/work stations. Their presence heralds the advent of UNIX, the only operating system with multi-tasking, multi-workstation capabilities, into the forefront of the systems competition.

The implication of this development for microcomputer users is that there will at some point be a more or less gradual move to UNIX, or some other more technically-oriented system, and program libraries currently in use under an independent, isolated operating system will no longer advance in technical sophistication.

Another important software trend which may be of particular importance to planners is the move to increased transfer of data between mainframes and microcomputers. This too will reinforce the trend to conformity of formats, as a greater need for compatibility of data arises. More uploading and downloading of data will also give planners the power to perform faster, more complex computer operations at less cost than was previously possible. It will also provide more power (in the form of the ability to work with a greater number of discrete databases) and time for new functions on the microcomputer. Programs that allow transfer of data between computers are listed in the software directory under 'Communications'.

With respect to CAD systems, the significant enhancement of three-dimensional processing capabilities is expected to be the earliest development. Many minicomputer-based CAD systems have powerful 3-D drafting and analysis capabilities. However, extensive use of these capabilities is limited to very specialized engineering disciplines such as automotive design. In planning, the most likely applications will be in a 2-D mode. An example of this would be landscape planning. Using 2-D capabilities, one could generate all landscape features and possibly even automate the quantity estimates on an area basis or per item basis. A visual 3-D display for presentation purposes is desirable but not readily achievable at low cost on microcomputers at this time.

Another area of expected CAD software development for microcomputers relates to database intelligence. As processing speed increases and storage increases for microcomputers, database intelligence will become a more reasonable demand of micro software. Another development which may be a catalyst for increased database intelligence is the development of software to allow micros to be used in geographic referencing systems. This requires the downloading of large mainframe or minicomputer data files to micros (which is currently being done by software developers and mapping companies).

There are several relatively expensive micro software packages available with 2-D capabilities. There are also inexpensive 3-D packages available such as 3 Design, MCS-3-D Space Tablet, etc., but the analysis capabilities of these packages is limited. These are referred to in the software directory.

HARDWARE SELECTION

Current technology

Having selected needed software, choosing the hardware required to run the software should be a relatively simple process. The choice will be limited by the selection of an operating system and memory capacity. After that, the machine that provides the best value for the requirements must be determined. The following are factors that should be addressed in this process:

- Storage requirements. These must be known for the chosen software. The purchased machine should have at least this much RAM (Random Access Memory). Many micros offer the option of increasing the RAM through addition of extra chips. This is certainly an advantage, and should be investigated for candidate computers. Both storage and processing capacity should be analyzed. There is also storage on floppy diskettes or hard disks: the former can be expanded at will, by purchasing more disks, although each file is still limited to the capacity of one disk; the latter are used for applications requiring extensive storage capacity. Storage on cassette tapes should be avoided, due mainly to its slow access speed.
- Volume of work. The volume of work to be done on the computer will definitely have an effect on the hardware required. If the anticipated usage is light, a single desk top micro and printer should suffice. However, if there is to be a large number of users, or if the users will be using the system for complex or lengthy operations, there can be a need for a local area network (LAN), a multi-user system or possibly a greater number of isolated micros. The best strategy would be to buy a system with expansion capabilities, if there is uncertainty regarding long-term requirements.
- Type of work. The type of work to be done will also affect the equipment requirements. For example, if the computer is to be used for report preparation, a letter-quality printer and plotter may be required. The availability of such devices, and their ease of interface with the candidate system should be analyzed. If graphics will be needed, the ability of the computer to produce them, or the cost of extra hardware for their production must be investigated.
- Communication features. Depending on the volume and type of work to be done, it may be necessary for the computer to communicate with other units. The capacity of the machines for this purpose must be determined in terms of equipment required, ease of use, software required, speed of communication, and types of interface possible.
- Speed. The speed of computer operation will be a function of the microprocessor and also of the speed of the printer (and plotter) employed. If speed is a key feature in required functions, the processing rate should be determined.
- Expansion potential. This is a crucial criterion in the choice of a microcomputer. Expansion features to look for are: ports for printers, plotters and communications devices, internal expansion slots for increased memory, added functions or colour graphics, and plugs for a mouse, digitizers or light pens.
- Available software. Microcomputers should also be investigated from the perspective of the software available for the machine. Check that input and output features and functions performed , meet needs. Buying a machine purely on the basis of what is presently required is ultimately limiting. Examine the range of software available for a variety of computers, and optimize any choice on the basis of long-term requirements.
- Support and service. Maintenance charges for a microcomputer can be estimated at 10% of the purchase price per annum. Examine the warranty and maintenance requirements and buy from an established dealer. Ask other users of a given system about their level of satisfaction, and if the dealer is willing and able to help with and rectify any problems with the machine.
- Physical features.

- The screen. Choose a screen based on the number of characters it can display (80 columns by 24 rows is becoming standard), on readability over an extended period of time (that is, size, colour and resolution of characters), and on screen features, such as full screen editing, upper and lower case letter display and audio signals.
- The keyboard. Keyboard features that may affect your system choice include the presence of function keys (used for frequent commands), a numeric keypad and cursor control keys, as well as the "touch" of the keyboard, and the location of keys. A keyboard arranged in a more convenient pattern for typing is now available. It is known as the DVORAK keyboard.
- The printer. A printer should be chosen on the basis of the speed and quality of output required. Other features to consider are the carriage width (80 or 132 characters) and the noise of the machine.

In summary, microcomputer hardware should be chosen on the basis of its overall suitability for present and anticipated functions. Most important is the provision of adequate memory and processing capacity to perform computations involving a substantial amount of data, the manipulation of which is one of the primary functions in a planning office.

Typical hardware configurations

There are a number of possible hardware configurations for a microcomputer system. The most basic is the simple desk top computer, possibly connected to a printer. Other configurations may be more appropriate to a given set of computing needs. Among these are:

- Mainframe access terminals. The important feature of these terminals is their ability to communicate with mainframe computers, combined with the abilities of a microcomputer. Configurations of this type may be obtained in two ways: a microcomputer advertized either as a mainframe access terminal or as a workstation may be purchased, or an independent micro may be expanded to mainframe access use by adding a modem, and a telecommunications package (see listings under "Communications" in the software directory). The advantages of the first alternative are that it is simpler and less prone to technical difficulties, while the second alternative has the advantages of being substantially less expensive and probably allowing greater flexibility of the choice of a computer. In either case, this configuration provides access to much more extensive databases and program libraries and more computing capacity than would be present otherwise.
- Service bureaus. These bureaus deal primarily with mainframe computers. Hence, it may be possible to link into a service bureau mainframe using a mainframe access terminal. Use of such a system could add flexibility and capacity to a system, though the cost could be the decisive factor.
- Local area network. These networks consist of two or more microcomputers linked by a wire cable. They share a hard disk, which provides high-capacity storage, and hardware such as printers or plotters. The advantages of such a system include the increased storage space, the ability for multiple users to access data at the same time, and the savings in time through multi-user file updating. Another feature is that costs of hardware and software can be shared among users. The disadvantages include the high capital investment and the amount of time required to set up the system. In future, these weaknesses may well be outweighed by added features, such as links to copiers.
- Multi-user systems. These are also known as super-micros. They can support from two to 32, 64 or 128 users, and provide an alternative to local area networks. The advent of larger microprocessors has allowed and will continue to encourage their expansion. Multi-user systems may be of two types: first, the multiprogramming machines, which operate on a time-sharing principle among users; and second, the multi-processor system, which provides one microprocessor for each user. These would be excellent systems for offices in which a large number of users wish to access the same databases and perform operations on them. The other pros and cons of such a system are the same as for local area networks: cost and complexity must be weighed against increased capacity and flexibility of use.

One final note is with regard to the purchasing arrangement for microcomputers. Rental or leasing of such machines will seldom if ever be a valid option. It is much more advisable to purchase a micro outright, so as to make a long-term commitment to one system.

Hardware selection relative to CAD and graphics

The selection of the basic computing unit may or may not be finalized at the time CAD applications are investigated. If a CAD software package is being considered for an existing micro there will be certain hardware additions required for a minimum configuration. It may be more cost-efficient in most cases to use a commercial agency to undertake the more difficult CAD work.

The distinction between CAD and graphics noted elsewhere is maintained in this discussion of hardware. Graphics is normally thought of as mainly hardcopy output of stored or generated data in the form of graphs, bar charts, etc. However, CAD involves the generation, manipulation and analysis of graphic elements such as lines, circles, polygons, etc. which are the database rather than a representation of it. Precise and accurate graphic input as well as output is a requirement for a CAD system. A system configured for CAD will accommodate lower level graphics output. The reverse, however, is not true.

Regardless of the type of computerized graphics being considered, a graphics processor is required. Graphic output for a spreadsheet requires a graphics processor as does graphic output for a much larger land use database.

The main computer processor must supply enough memory to satisfy the software operation demands. Most processing units can be upgraded as required. Graphic input can be made through a keyboard or through a graphic input device such as a graphics tablet (mouse, digitizer, etc.). This peripheral device can be used to operate a command menu as well as to input information by drawing. Many graphic input devices have physical resolution greater than can be produced manually.

A brief discussion of physical resolution is appropriate here. It should be a factor in the selection of each graphic peripheral and will depend on the drawing resolution offered by the coordinate system set by the software. The coordinate database developed electronically can provide resolution far greater than standard display requirements, depending on the size of the applications.

Manipulation of graphic databases can be viewed on a graphics display monitor. Even the most sophisticated and costly graphics monitors can still be considered a weak link of the graphic peripheral devices. They offer the fewest number of data points with which a graphic element can be displayed. For example, standard text-display monitors would not provide a satisfactory final output device since most graphic elements would appear to be very jagged. Higher resolution monitors will provide better visual output quality and allow hardcopy colour output using photographic or video devices. The accuracy problem of low resolution monitors is reduced significantly with floating point software which have zoom capability.

The same type of resolution considerations should be applied to selection of hardcopy output devices or plotters. Resolution of plotters is measured in two ways - addressable and mechanical. Addressable resolution is the smallest pen movement which a user can command the plotter to draw while mechanical resolution is the smallest possible pen movement which is a function of the mechanical design of the equipment. The higher the resolution, the smoother will be plots of arcs and diagonal lines.

Several other factors should be considered before selecting a plotting device: repeatability/accuracy, size of output, number of colours, plotter intelligence, etc.

The choice of plotting device is critical since it produces the final product. Where production of graphic hardcopy output varies widely relative to size, resolution, accuracy, etc., a very sophisticated plotting device may be justified to satisfy all needs.

Future developments in hardware

Microcomputer hardware is evolving at a rapid rate as new developments in electronics technology find applications in computer systems. One of the most important trends in hardware development is the continual advance in processing power. Originally, the functional basis of the microcomputer was the 8-bit microprocessor chip. These are being rapidly displaced by microcomputers containing 16-bit microprocessors, and now 32-bit microcomputers are being introduced. This development translates into much greater computing power and sophistication for micros, allowing programs of greater complexity and size to be run.

The second important trend in microcomputer development is that of increasing memory capacity. Initially, microcomputers with 64K RAM memory were perceived as having a great deal of memory and hence a great deal of computing power. Now microcomputers with many times this capacity are becoming common. This permits micro users to perform operations on substantially larger data files, using programs of increasing complexity, written in more technically-oriented languages. This trend towards greater memory capacity will certainly continue.

This trend towards increasing microcomputer memory capacity and processing power is reinforced by a parallel trend in the development of peripheral equipment (printers, plotters) towards offering more sophisticated, "quality" products and functions at lower cost. An example is the proliferation of colour ink-jet printers and daisywheel printers. These developments will permit further integration of microcomputers into office environments as they become more professional tools for word processing and report generation.

One final trend in hardware development may prove to be crucial in determining the future of microcomputer hardware. This is the development of the mainframe-to-micro link, and the production of microcomputers designed to serve equally well as work stations for mainframes (the IBM-XT and 3270-PC). These developments, combined with the imminent widespread use of 32-bit micros and greater memory will result in the appearance of microcomputers with computing ability comparable to that of mainframe computers. This will give greater support to the use of high-level programming languages, and to the spread of standard operating systems, (probably UNIX) capable of support by 32-bit computers.

In summary, these hardware developments will lead to greater computing capacity, faster processing power and sophisticated communications. They will also result in greater penetration of the workplace by microcomputers.

APPENDIX 1

GLOSSARY OF COMPUTER TERMINOLOGY

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access

To obtain (gain access to) information in the computer or on a storage device, usually by way of a disk.

accessory

See **peripheral.**

acoustic coupler

A device that allows a telephone receiver to be connected to a modem. This term is often used to refer to both the modem and the acoustic coupler. See also **modem.**

address

The physical location of an instruction or data set in internal memory on any storage medium.

application program

Software designed to handle a specific task, such as word processing, electronic spreadsheeting and database management.

ASCII

Acronym for American Standard Code for Information Interchange. A standard for data transmission adopted in 1968 uses combinations of seven bits to represent 128 letters, numbers, symbols and commands.

asynchronous transmission

A means of transmitting data in which a timing synchronization between the sending and receiving devices is not needed in order to decode the characters. Instead, each character is surrounded by one or more start and stop bits in order to designate the beginning and ending points of the information. A typical asynchronous input to a computer is that provided by a person typing on a keyboard.

backup

Duplication of a program or file onto a separate storage medium so that a copy will be preserved against possible loss or damage to the original.

BASIC

Beginner's All-purpose Symbolic Instruction Code. High-level programming language that is popular for personal computers primarily because it is easy to learn and use.

baud rate

A measure of speed at which data is transmitted, expressed in terms of the number of bits (0's or 1's) per second. Common baud rates are 110, 300, 1200, 2400, 4800, and 9600.

binary

The fundamental number system used with computers. Binary numbers are represented by only two numerals, 0 and 1. The binary system is necessary because electrical circuits store and sense only two states: ON and OFF.

bit

From BInary digiT. Smallest unit of information a computer can handle. Eight bits make a byte.

blink

A feature on a CRT that lets the computer flash characters on and off. Blinking is often used to show the operator where the cursor is, to call attention to errors, or to emphasize the data that is currently being entered.

board

A plastic resin board containing electronic components such as chips and the electronic circuits needed to connect them.

boot

To load a program into RAM, where it will remain until the system is shut off or rebooted or has a new program loaded in.

bootstrapping

The processing of initializing the computer for use by automatically clearing memory and loading the first few instructions, which call other instructions, etc. This is all the computer needs in order to get itself started. The term is based on the term 'to pull oneself up by the bootstraps'. Also called booting. Bootstrap program is stored in ROM.

bug

An error in a program which causes the program to operate incorrectly. On an early project, problems were caused by a moth in the hardware. Subsequently, all errors were called bugs. To debug means to remove errors in a program.

bus

Electronic pathways for moving and controlling data within a computer. A computer uses data, address and control buses.

business graphics

Program that allows you to present numerical data in a visual form, such as bar and pie charts.

byte

Fundamental unit of computer information, composed of 8 bits, required to define a single character. One byte can hold one typed ASCII character or any number in the range 0 to 255.

cathode-ray-tube (CRT)

The display device that forms the screen in television sets, video monitors, and video terminals. Also see **monitor.**

cell

Block of space in an electronic spreadsheet program at the intersection of a particular column and row.

central processing unit (CPU)

The main hardware control unit. Traditionally it incorporates the central processor, main memory and input/output controller.

COBOL

COmmon Business-Oriented Language. High-level computer programming language developed primarily for business applications in medium-size and large computer systems.

CMOS

Complementary Metal-Oxide Semiconductor. New technology used to produce microprocessor chips. This type of chip is being used mainly in Notebook computers because they take less power and can therefore be used with batteries.

compiler

Computer program that converts another program, usually an applications program, into machine code that can then be run (compare with interpreter).

computer chip

A piece of silicon, about a quarter of an inch square, which contains micro-miniaturized electronic circuits. Can act as a processor or memory unit, or could eventually contain a complete computer.

configuration

The combination of equipment, that is, a disk, printer, microprocessor, that makes up a particular microcomputer system.

copy-protected

Refers to software designed to prevent the user from making a copy.

CP/M

Control Program/Microcomputers. Widely used, independently developed operating system available for most popular 8-bit personal computers. CP/M is a registered trademark of Digital Research.

CP/M-86, CP/M-68K

Version of the CP/M operating system for 16-bit computers.

cursor

Indicator that tells you where you are on the computer screen. The cursor is usually displayed as a blinking character.

daisywheel

A wheel used with printers to produce letter quality characters.

data base

Collection of related information that can be stored and retrieved on a computer. For example, personnel files, land use files, building files can be accommodated in a data base.

database management

Program that makes the computer a tool for organizing information, replacing manual systems such as file folders and index cards.

data bus

A bus that is used to transfer data between the CPU and the memory.

data file

A file that contains data rather than programs.

debugging

The identification and elimination of errors within a program.

default value

Values supplied by the computer system itself when no explicit value is received from the program or user.

digital

Representation of information by discrete numerical quantities such as binary digits in modern computing.

digitizer

A device that converts analog measurements, such as a drawing, into digital form for input into a digital computer.

direct connect modem

A modem that plugs directly into a telephone outlet, bypassing the handset. It enables users to send and receive signals directly to and from telephone lines. See also **acoustic coupler.**

directory

List of data and program files recorded on a disk.

disk (diskette)

General name for magnetically coated recording device for permanent storage of information. Also see **floppy disk** and **hard disk.**

disk drive

Device that holds and rotates a disk at high speed. A disk drive contains a read/write head to play data back from and record data onto a disk.

disk storage capacity

Number of characters that can be stored on a disk. Floppy-disk storage capacity is usually measured in kilobytes, thousands of characters, and hard-disk storage capacity in megabytes, millions of characters.

display

What is shown on the monitor screen or the monitor.

display screen

A TV-like screen which displays computer output. Also see **monitor.**

distributed

Distributed processing means placing computing facilities at points where they are required to perform a task rather than centralising all computing functions.

documentation

Written instructional and tutorial material that comes with hardware and software products to help you learn to use them.

DOS

Disk Operating System. A system that allows the user to transfer programs and data to or from a disk. There are many different (usually incompatible) disk operating systems.

dot-matrix

Characters defined by a set of dots closely packed together within a grid. Printers using this method of forming images are called dot-matrix printers. More dots produce better quality print.

double density

Describes how tightly the information can be packed onto one side of a disk. Most current systems use double-density disks and drives.

double sided

Describes a disk that can store information on both sides.

download

Transfer information stored in a remote computer to the user's micro. See also **upload.**

dumb terminal

A terminal that has no computing capability of its own, sometimes called a teletype (TTY) replacement or a glass teletype. The user cannot process data on a dumb terminal unless it is connected to a computer.

(eight) 8-bit processor

A microprocessor that handles eight bits (one byte) of information at a time.

editor

A computer program that lets the user prepare printed matter (text material) or input for other programs. It allows the user to correct, add, delete, or re-arrange material.

emulate

To imitate one system with another system so that the imitation system is perceived to be the same as the original. The modification that occurs affects the hardware and not the software that will be run. Also see **terminal emulator.**

EPROM

Erasable PROM. A ROM that can be erased by exposing it to ultraviolet light. Complete erasure usually takes 20 to 30 minutes. (See **PROM**).

escape

Key specific to computer keyboards that can be used in some programs to interrupt what is being done, withdraw the most recently entered command and restore the screen to its previous state.

external memory

See **mass storage.**

field

Lowest level of information in a data base. A field is a specific item of information within a record.

file

Collection of related information, usually stored on a disk. A file is also the largest unit of organization in a data base.

firmware

Software that is in ROM and is therefore not accessible to the user. It controls the internal operations of the computer system such as translation of keyboard commands, or to get the computer ready to accept instructions when first turned on.

floppy disk

A flat, round, flexible piece of plastic resembling a 45-rpm phonograph record, which has a magnetically coated surface for recording information for permanent storage. The most common floppy-disk size is 5-1/4 inches. Also available in 3-1/2" and 8" sizes.

FORTRAN

FORmula TRANslator. High-level programming language used primarily by scientists and mathematicians.

full duplex

Capable of both receiving and transmitting at the same time. This term is used to refer to communications lines.

function key

A key that causes a computer to perform some operation, such as executing a procedure, deleting lines, or some other valid command. These keys are often used by software packages to perform commands with a single keystroke.

graphics

The display of pictures on the screen.

graphics tablet

Flat surface upon which freehand drawing can be done to interact with the computer. A graphics tablet is sometimes used instead of a keyboard to enter information.

half duplex

Capable of receiving and transmitting, but not both at the same time.

hard copy

Printed version of information that has been entered into a computer. Output that is in a permanent form.

hard disk

A rigid disk that is faster to use than a floppy disk. It is more expensive, but capable of storing much more data.

hard-disk drive

Rigid disk or disks in a tightly sealed box, used for storing information. Most hard disks are non-removable, a type also known as Winchester drives. A hard-disk drive provides more storage capacity and faster access to information than a floppy disk.

hardware

The physical equipment that makes up a computer.

help

A function available on many systems, it can make available to the user information on points that need further explanation.

hertz

A unit of frequency equaling one cycle per second.

hexadecimal

Number system with base 16, uses the decimal digits (0 through 9) and the letters A through F (to represent the numbers 10 through 15) as its digits.

highlighting

A method whereby a computer will make one line brighter than the others.

high resolution

Refers to the quality and accuracy of detail that can be represented by a graphics system such as a video display or a printer. Resolution quality depends upon the number of basic image-forming units (pixels) within a given area. The greater the number, the higher the resolution.

home key

Key on some computer keyboards that moves the cursor to the 'home' position, the upper-left corner of the screen.

horizontal scrolling

Ability of the system to shift horizontally blocks of lines of text or data in order to view more characters than can fit on the screen at one time.

IC

Integrated Circuit. A complete electrical circuit on a single chip.

initializing

Also called formatting. Preparing a blank disk to record information. All disks must be initialized with the system you are using before they can receive information.

input

To enter information into a computer, usually by means of a keyboard. Information to be put into the computer is called 'input'.

input devices

All those devices which enable one to enter information into the computer are called input devices. For example a keyboard, disk drives, joysticks, light pen and a mouse are all input devices.

integrated software

Several application programs packaged together in a single unified piece of software. Each application is intended to work with the others, sharing data and a common set of commands.

intelligent terminal

One that is not a dumb terminal. See **smart terminal.**

interactive

Capable of carrying on a dialog with the user rather than simply responding to commands. An application in which the user is involved in a two-way dialogue directly with a computer.

interface

Electronic circuitry that allows two different devices to be joined.

interpreter

A program designed to translate high-level language instructions (source code) into binary machine code (object code). An interpreter translates each individual high-level statement into object code and executes it before reaching the next statement. Once the statement has been executed, its object code is discarded and that statement must be re-translated if it is encountered again. This can be time-consuming, particularly in loop conditions. Interpreted programs tend to run more slowly than compiled programs, where all the statements are translated before execution.

K

2^{10} or 1024. The term is used to mean 1024 bytes when referring to the size of a computer memory; it is also used to mean 1024 bytes when referring to the amount of memory on a single chip, or a disk storage capacity.

kilobit

1024 bits, also referred to as 1K bits.

kilobyte (KB)

1024 bytes, also referred to as 1K bytes or simply as 1K.

LAN

Local area network. A system allowing several concentrations of computers and terminals within a local area to share resources such as peripherals, software, or data. This encourages low-cost computer-based work stations throughout an office or campus, all of which have access to expensive peripherals such as hard disk drives, printers, or databases without the cost of equipment duplication. In addition, enhanced communication between work stations avoids repetition of work. Various configurations of networks are available, as well as gateways capable of connecting several networks to each other.

light pen

A stylus-shaped photosensitive pointing device that allows interactive communication between a computer user and a terminal screen. When the user touches the pen to a position on the screen, then that coordinate on the screen is input as data to the system.

load

To transfer a program and its data from a disk to RAM.

machine language

Language that computers understand, consisting of binary code.

macro instructions

(1) A frequently used set of predefined instructions designed to perform a specific operation. The function is associated with one code word that is defined by the user. Code words (macros) are inserted within the main program where needed. The code word references the predefined macro instruction set (body), which is a separate machine language routine or assembly routine. Using a macro, a user can define a recurring task just once and then, when that task is called for, the macro can be substituted. This will shorten program length, but a special macro assembly program is necessary to expand the macro into its body and into machine code. The macro is a shared resource in that its access is not restricted to one program.

A macro differs from a subroutine in that when a macro program goes through the translation (assembly) process, the code for the macro key word is actually inserted into the program. Therefore, when the program is executed, those 'substituted statements' are read sequentially and there is no transfer of control to any other area of memory. A subroutine, on the other hand, uses a call statement that is executed in order to transfer control to a different area.

(2) In word processing, the macro can be a word or phrase that is called up when a code word is used. The code word is sometimes called a 'token'.

main memory

Immediately accessible memory for programs and data storage. It normally includes ROM and RAM, but excludes mass storage devices. Main memory is integral to the computer. Also called internal memory, primary storage or simply memory. Main memory (RAM) provides temporary storage of programs and data for computer use.

mainframe

Large and expensive computers generally associated with established manufacturers (such as IBM, Honeywell, Univac, etc.).

MIS

Management Information System. Provides business information helpful to managers including inventory, sales, payroll, accounts payable and receivable.

mass storage

Large-capacity (megabytes, gigabytes) secondary storage systems. Typical mass storage devices are recording tape and magnetic disks. Also called external memory. Mass storage provides means of storing information on a permanent basis.

megabyte

1,048,576 bytes or storage locations usually denoted by 1M byte.

memory

The working area of the computer, the place where programs and data are stored while the computer works with them. The two most common types of computer memory are random-access memory (RAM) and read-only memory (ROM). Another kind of memory, storage or off-line memory, refers to the amount of information a disk or other storage device can hold.

menu

A list of valid options presented to the user from which a choice is made.

menu-driven

A piece of software that functions by the use of menus.

microdiskette

Small disk, usually with a 3-1/2 in. diameter.

microprocessor

A single-chip central processing unit.

minicomputer

A faster, larger, more expensive computer than the micro that has more than one processor chip. The dividing line between minicomputers and microcomputers is becoming less distinct. The term 'mini' used to refer to a 16-bit machine, while a 'micro' was an 8-bit machine. Today there are 16-bit microcomputers and 32-bit minicomputers.

modem

Stands for MOdulator/DEModulator, a box-like device that changes signals generated by a computer into signals that can travel over telephone lines and vice versa.

monitor

Hardware resembling a television set that displays information in a computer's memory. Also called VDT, CRT or display screen. Cannot receive TV signals.

MOS

Metal-Oxide Semiconductor. Technology used to produce chips.

MS-DOS

Micro Soft Disk Operating System. Relatively new, independently developed operating system available on many 16-bit personal computers, most notably the IBM-PC. It is becoming a standard (similar to CP/M for 8-bit processors) for machines that use the 808x series microprocessors.

mouse

Hand-controlled device used to control the cursor in order to enter, or input information into a computer. A mouse has a ball on the bottom that rolls freely on a flat surface, allowing you to draw with the cursor or to point quickly to an item on a screen to make a selection.

network

A series of interconnected computers, peripherals, and/or terminals communicating with each other. Networking allows computers to share certain devices such as hard disks and printers. See **network, local area (LAN).**

numeric keypad

Group of number keys on some computer keyboards, arranged like keys on a calculator, to allow you to enter figures rapidly.

off-line

Activities related to computer tasks which are not carried out in direct communication with the processor (or computer). For example data may be keyed on to a diskette (off-line).

on-line

Mode of operation where work is carried out in direct communication with the computer.

operating system

Program that serves as an intermediary between software and hardware. An operating system mediates for application programs, allowing them to use the computer and its resources: memory, screen, printer and disk drives. CP/M, MS-DOS, XENIX are some of the operating systems used in microcomputers.

output

Information which is passed from the computer to the user is called output. It also refers to the act of producing some sort of information for the user. Output can be in the form of words, numbers, graphs, maps or simply electronic signals for transmission.

parallel

Data transmission in which a number of bits are transmitted simultaneously over separate wires.

parity

A code used to detect recording or transmission errors. Parity is a 1-bit code that makes the total number of one bits in a unit of data, including the parity bit itself, odd (**odd parity**) or even (**even parity**).

Pascal

High-level language widely used on personal computers. Pascal is more complex than BASIC, and it is a more efficient and powerful programming tool.

PC-DOS

Version of MS-DOS used in the IBM Personal Computer.

peripheral

Hardware other than the computer itself, such as a disk drive, printer, accessory board, keyboard, screen, plotter, etc. that can be controlled by a microprocessor.

pixel

(PICture ELement) One of the group of tiny dots that form the characters or graphic images on a computer screen. The more pixels the higher resolution a screen will have.

plotter

Type of printer having an arm with a pen attached that moves to create charts, maps or graphs.

poke

A statement used in BASIC programming language to place data directly into a specified memory location.

portable computer

Usually refers to the physical size of certain computers that may be conveniently hand-carried and which are about the same dimensions as a small typewriter.

printer

Machine, much like a typewriter without keys, used to make a hard copy of information in a computer.

processor

Hardware unit which performs arithmetic, controls the sequence of processing, input/output operations and access to memory.

program

An organized set of logical instructions directing the execution of a specific task or the solution of a problem by the computer.

program function keys

Keys on a computer keyboard that are defined to do different things with different programs. Typically, they allow frequently used commands to be activated by a single keystroke.

PROM

Programmable Read-Only Memory. A memory that cannot be changed during normal computer operations, but that can be programmed under special conditions. Some PROMs (called EPROMs) can be erased with ultraviolet light and reused.

prompt

A message that appears on the computer screen asking you to do something or provide more information to enable the program to proceed.

quit

To discontinue work with a particular program but continue work with the computer.

QWERTY

The name used for the standard typewriter keyboard layout and containing those six letters in one row in that arrangement. This is the keyboard layout found in microcomputer terminals.

random-access

Referring to a storage device from which any data can be removed in the same amount of time. A disk or a computer memory is random-access, whereas a cassette is not. See **sequential.**

RAM

Random-Access Memory. Also called read/write memory. The place in the computer where active programs and data are stored and worked on. Random-access memory is temporary. The data stored in it disappears when the computer is turned off. When in RAM, data can be read, worked with, added to or modified.

read/write head

A device much like an audio tape playback/record head, located within a disk drive, that transfers information between a disk and the computer.

read/write memory

See **random-access memory.**

read/write slot

Oblong opening in the covering of a floppy disk that exposes the disk and allows the disk-drive head to read and write information on it.

real time

A method of processing where response is 'instantaneous'. Applies to tasks (such as air traffic control) where immediate response to an input is required. Loosely the term is used for all on-line operations.

reboot

See **warm boot.**

record

Second largest collection of information within a database. A record consists of information about a single subject within a file.

resolution

Describes the sharpness of characters as they appear on the monitor. A screen with high resolution has characters that are clear, sharp and easy to read. It also has the capability to produce detailed graphics.

reverse video

A feature on a CRT that the computer can use to produce the opposite combination of characters and background from that which is usually employed, that is, white characters on a black background if black on white is normal, and vice versa.

RF modulator

A device which enables an ordinary TV screen to be used as the display screen of a microcomputer.

ROM

Read-Only Memory. The place in the computer where special system programs are permanently stored. Unlike random-access memory, information stored in read-only memory cannot be modified, and it does not disappear when the computer is turned off.

save

To move information from computer memory (RAM) to a disk to be retained for use later.

S-100 bus

A standard interface, consisting of 100 parallel connections, used to connect circuit boards inside personal computers. See **bus.**

scroll

To move lines of information up or down on the screen.

secondary storage

See **mass storage.**

sector

Fixed-size section of a track on a disk. Each track is divided into eight or more sectors.

sequential

Referring to a storage device from which data can be removed only in a specific order, one piece after another. For example, the information on a cassette can only be retrieved in the order in which it appears on the cassette. In addition, finding a given piece of information from a tape can take an unpredictably long time, depending on the location of the information. See **random-access.**

serial

Data transmission in which each bit is transmitted separately and sequentially.

(sixteen) 16-bit

A microprocessor that handles sixteen bits of information at one time. A computer with a 16-bit processor can work with more memory (RAM) and process more information at a time than a computer with an 8-bit processor.

small business systems

Hardware and software packaged to solve business computing needs of smaller companies or departments. Prices can range from about $2,000 and up.

smart terminal

A terminal that has computing capability of its own and is not totally dependent on the computer to which it is attached.

spreadsheet packages

A piece of software that allows you to play 'what if' with your data. The package creates a grid for data entry. Each cell is filled with a value and the package calculates the results. There are built in functions to do complicated formula, etc.

software

Set of instructions to a computer. It is software that makes a computer accomplish specific tasks, such as word processing and database management. Generic term for programs.

sort

To arrange data items according to identification criteria, such as identification (ID) number, alphabetical or numerical order, etc.

spelling checker

Software that proofreads by comparing each word in a text file to a dictionary, then marks and/or indicates misspelled words.

spreadsheeting

Application program used for financial analysis and modelling. A spreadsheeting program allows the setting up of complex mathematical relationships among numbers displayed as a worksheet, with rows and columns, to determine how varying factors, such as cost of goods and overhead, might affect other factors, such as profit and loss.

storage

An overall term for a category of devices capable of holding data that may be retrieved at any time once it has been inputted.

storage capacity

The total amount of data stored per unit of media and which may be accessed by the system without changing media.

symbol table

A table defining all the names and labels used in a program.

synchronization

A method of transmission in which the timing of each bit of data is precisely controlled.

synchronous data communication

A transmission of data in which transmitting and receiving devices are synchronized to a common clock signal.

system disk

Disk containing the operating system.

systems software

Programs that control the execution of user or applications programs, and which include compilers, assemblers, debuggers, utilities, and operating systems. There are usually supplied by the hardware manufacturer.

template

There are two types. **Keyboard template** made of cardboard or plastic to fit on to keyboard to show key functions in a certain program. **Program template** sets out steps to be followed to achieve a particular result, e.g., a budget template for a spreadsheet package.

terminal

Hardware configuration consisting of a keyboard and monitor that is capable of sending and receiving information, but has no memory or processing capability.

terminal emulator

A piece of software that makes a microcomputer act like it was a real terminal, that is, it emulates/simulates the specified terminal. For example, the IBM PC microcomputer can be emulated to act as a TELIDON terminal.

text editor

Software that allows the use of a computer to enter and make simple changes in text. It is not as useful a writing tool as word processing. Its primary function is to help in writing programs.

thermal printer

A printer that forms characters by applying heat to special heat-sensitive paper.

time sharing

An installation in which a central processing system, usually a mini or mainframe computer, serves more than one user, either locally or by telecommunications.

TRSDOS

Tandy Radio Shack Disk Operating System. See **operating system.**

tutorial

Instructions about running hardware and/or software, usually in manual or program form.

UCSD p-System

Operating system available on some personal computers. It is designed to facilitate programming in the Pascal language.

UNIX

Operating system developed for mini and microcomputers, a version of which, XENIX, is available on some personal computers.

upload

Transfer information stored in the user's system to a remote computer system. See also **download.**

user friendly

Refers to software and hardware systems that are supposedly easy for a user to learn to operate without requiring a great deal of specialized knowledge or training.

VDT

Visual Display Terminal - see **monitor.**

video monitor

A television-like display device, differs from a normal television set in that it cannot receive television signals.

videotex

Internationally agreed term for viewdata.

warm boot

Also reboot. A way of interrupting work with the computer that wipes out whatever you were working on and reloads the operating system into computer memory (RAM). Should be used only when you are unable to quit a program normally, by means of a command.

Winchester disk drive

See **hard-disk drive.**

window

Section of a spreadsheet or word processing text that is displayed on the screen at any one time. Some programs allow multiple windows to be viewed.

word processing

Application program used for writing. Word processing allows the composing, editing and working with text while it is inside the computer and displayed on a screen before it is committed to paper.

word wrap

Word processing feature that eliminates the need for hitting a return key at the end of a line. When a line becomes too long, text automatically breaks at a complete word and continues on the next line.

working space

Amount of space left in memory (RAM) after the operating system and application program have been loaded.

write

For a computer to record information in memory on a disk or through a printer.

write-protect notch

Small cutout on a disk that indicates whether information can be recorded on that disk. Its purpose is to prevent accidental erasure or reuse of valuable disks.

XENIX

A version of the UNIX operating system for personal computers.

APPENDIX 2

TYPES OF COMMERCIAL AND NON-COMMERCIAL COMPUTER PACKAGES IN USE IN ONTARIO (PLANNING AGENCIES)

PACKAGE NAMES

1. **Training**
   - Lotus Tutor
   - Professor Dos
   - The Instructor
   - Diskette - Librarian
   - d Base Tutor

2. **Integrated**
   - Lotus 1-2-3.
   - Mapper
   - Peach Calc
   - Symphony

3. **Statistical Analysis**
   - Stat Pac
   - SPSS
   - SAS
   - SCSS
   - Statistical Package
   - * Manor Levelob
   - * HOAS

4. **Transportation Planning**
   - Motors
   - TPS
   - UTPS
   - Transportation Model
   - STP-CP
   - TRSTRANS
   - * System 33
   - * Cordon Count
   - * Transportation Package (MTC)

5. **Spreadsheet**
   - NyPlan
   - Multiplan
   - Visicalc
   - SuperCalc 3
   - Magicalc
   - Supercalc 2

6. **Word Processing**
   - Data Star
   - Wordstar
   - Peach Tree
   - Spell Star
   - Grammitik
   - Apple Writer 3
   - Scriptsit
   - Dictionary
   - Programs for AES
   - Programs for Honeywell
   - Keypad Editor
   - Easy Writer
   - Correct Star
   - Star Index
   - Honeywell Word Processing Package

7. **Database Management**
   - d Base II
   - Info Star
   - Easytrieve
   - PFS-Data Management
   - Extracto
   - APLDI
   - TIM
   - Profile Plus
   - Mark IV
   - Realtime Data Manager (RDM)
   - PFS-file
   - Spires
   - d Base III
   - Autocode
   - Informix
   - TOPOS
   - * OMIS
   - * Development Information System
   - * GRS
   - * LUDBM
   - * RISC
   - * plus
   - * Micro-F.C.S.

8. **Mapping/Graphics**
   - Graphics Package for Radio Shack
   - GIMMS
   - Graphics Programs for Mini (BASIC Phase 4)
   - Honeywell Graphics package
   - Datagraph

9. **Mailing Lists**
   - Mail Merge

10. **Communications**
    - IRMA
    - EZSHAR

Apple Access 2
PFS-Report
PC Net
POLY-XFR
PFS FILE
Apple Access 3

11. Forecasting

Population Model
Projections 5
* Cohort Survival program
* Population Projection Model
* Metro Model
* Population and Employment Model
* TR 1907

12. Retail Modelling

Scope
Retail Impact Model
* Retail Simulation Model
* Retail Gravity Model
* Collen Model

13. Miscellaneous

Quickcode
Stairs
APS
Basic Compiler
Fortran Compiler
Macro Assembler
Cobol Compiler
WATCOM editor
Milestone
Pascal Compiler
M Basic
CP/M-86-80
* MOE Noise Analysis Package

NOTE

* Non-commercial packages

PROGRAMS IN COMMON USE

Program	Type	Frequency (Number of Municipalities)
SPSS	Mainframe	9
SAS	Mainframe	7
Motors	Micro	5
VISICALC	Micro	5
Lotus 1 - 2 - 3	Micro	4
Wordstar	Micro	4
d Base II	Micro	4
Stat Pak	Micro	3

APPENDIX 3

MUNICIPAL SURVEY INFORMATION

HARDWARE AND SOFTWARE

HARDWARE AND SOFTWARE

Municipality	Hardware	Commercial Packages	
CITY OF BRAMPTON Contact Person John A. Marshall, Director of Planning Policy Tel: (416) 793-4110 ext. 251	• 1 IMB PC with printer • City's ICL minicomputer • MICOM word processor	• Lotus 123 – micro • Datastar • Stat Pac – micro	(2)* (6) (3)
CITY OF BURLINGTON Contact Person Gary Goodman Director of Planning Tel: (416) 335-7825	• 1 Terminal connected to City's mini computer (Wang US90) with daisywheel printer • 1 Wang P.C. micro computer 128K. Also connected to City's mini • The two terminals are interconnected	• Intend to get Multiplan (5) package • Terminals used to access word processing and other software in the City's minicomputer	
TOWN OF CALEDON Contact Person Brian Savard, Senior Planner Tel: (416) 584-2273	• 1 IBM PC, 128K with NEC Spinwriter Printer	• Wordstar – micro • Mail Merge – micro • Visicalc – micro • d Base II – micro	(6) (9) (5) (7)
CITY OF CHATHAM Contact Person M. Howell, Planning Director Tel: (519) 352-4500	• 1 IBM PC shared with another dept. • 2 Word Processors IBM Display Writer and Wang • one terminal linked to City's mainframe IBM 360	• Peach Tree – micro • Lotus 123 – micro • TIM – micro	(6) (2) (7)
REGIONAL MUNICIPALITY OF DURHAM Contact Person George Lysenko, Manager, Projects Branch Tel: (416) 668-7731	• 1 IBM PC 512K RAM 10 MB hard disk 2 floppy disk drives with high speed dot matrix printer • 3 Word Processors AES • IBM XT 512K RAM 10 MB hard disk 1 floppy disk drive using dot matrix printer	• Symphony – micro • Visicalc – micro • d Base III – micro • Wordstar – micro • Tutorials for Lotus and d Base – micro • Professor DOS – micro • The Instructor – micro	(2) (5) (7) (6) (1) (1) (1)

*** Numbers refer to categories as shown in Part 2 – Overview of Ontario situation – computer software and Appendix 2**

Other Packages/ Programs	**In-House Programming**	**General Information & Comments**
• None	• Programming for streets names, library, development applications	• Most analytical work done in Planning Dept. can be done by IBM PC or other micro computer • Larger computers are required for massive models and data banking • Learning the IBM PC is taking time from other duties • Better planning analysis as a result of computers
• Hope to develop programs for: – monitoring the status of development applications	• None	• In future will acquire more micro computers • All computer needs are looked after by Corporate Management Committee. Planning has been low priority so far • Major benefit of computers has been in word processing • A municipality getting into computers should: – take corporate approach – have policies to guide in evaluating options – first applications should be word processing and land property information
• None	• None	• Improved productivity (eg report editing) • Problems with allocating staff time to learn how to use computers • Be willing and prepared to spend time to learn how to use computers
• None	• None	• None
• MOE package – micro (13) – Noise analysis package • RISC – mainframe (7)	• Data entry program (IBM PC) for employment survey and forecasting • Statistical program for IBM PC for statistical analysis • Demographic package, Cohort survival labour force, and migration constraints are a part of the package It is now being adapted to microcomputer system	• Have made effective use of computers, and will be used much more in the future • Using the computer has achieved: – effective data handling – monitoring of various activities – increase productivity • Aid to decision making • Staff did not go to any formal courses

HARDWARE AND SOFTWARE

Municipality	Hardware	Commercial Packages
REGIONAL MUNICIPALITY OF DURHAM (con't)	• IBM PC 640K RAM 38 MB Fixed per 6 MB removable hard disk 2 floppy disk drives with daisy-wheel printer • Department's IBM PC is linked to Canada Systems Group mainframe (IBM 4340) in Mississauga with Hayes Smart Modem • Also utilize services of computer Sciences Canada Ltd.	• Motors – micro (4) • Mail Merge – micro (9) • Correct Star – micro (6) • Star Index – micro (6) • Fortran Compiler – micro (13) • Basic Compiler – micro (13) • Macro Assembler – micro (13) • Stat Pac – micro (3) • PC Net – micro (10) • dBase plus (7) • Autocode (7) • d Base III compiler – micro (13)
COUNTY OF ESSEX Contact Person Peter Niece, Senior Planner Tel: (519) 776-6441 ext. 226	• 2 Word Processors (AES) shared with Administration Dept. • Have used facilities at Western University and University of Windsor	• Population Packages – Pop Projections – mainframe (11) – Proj – 5 – mainframe (11) University of Western Ontario packages originally acquired from U.S.A.
CITY OF GUELPH Contact Person Matt Reniers, Planner Tel: (519) 822-1260	• No hardware in Planning Dept. Use University of Guelph's computer facilities • Share Melna 1500 word processor • Treasury Department Sperry Univac 90-30 also used	• None
REGIONAL MUNICIPALITY OF HALDIMAND NORFOLK Contact Person John Raycroft, Planner Tel: (519) 587-4911 ext. 190	• University of Waterloo mainframe IBM 370 via Data Pac • In house dedicated word processor (NBI) – 2 work stations and one printer in Planning Department • IBM PC XT connected to word processor and can be used as an additional terminal	• SPSS – mainframe (3) • SAS – mainframe (3) • Fortran Compiler – micro (13) • Cobol Compiler – micro (13) • d Base III – micro (7) • WATCOM Editor (13)

Other Packages/ Programs	In-House Programming	General Information & Comments
	• Commercial Assessment Model – mainframe (12)	• Staff use of computer facilities increasing – limited only by access limitations • When getting into computerization: – should identify needs – should seriously consider the micro computer
• None	• Programming in Fortran in order to use University of Windsor's computer	• No active plans to computerize, wait and see attitude • Arrangement with Western University is working well
• Retail Gravity Model – mainframe (12) • Cohort Survival Program – mainframe (11)	• Just to amend some programs • Have used Data Services Section of Treasury Department	• So far have not made effective use of computers • Computers have been used for ad-hoc applications • One person can program in Fortran
• Script – mainframe (6) • Population Projection Model – mainframe (11) • RISC – mainframe (7)	• Programs are written in Cobol and Fortran • Programs to retrieve assessment data • Programs to supplement commercial packages	• Created a useful housing and population data base • Planning Department is providing information to other departments • Provides service to private sector • Time saving device • Ability to have up-to-date information • Quick historical comparisons • The cost of sharing the mainframe computer time discourages people from using it • A micro computer would certainly be used more • Staff has had some computer training • Municipalities getting into computerization should: – clearly identify what they want – find what others are using to solve similar problems

HARDWARE AND SOFTWARE

Municipality	Hardware	Commercial Packages
REGIONAL MUNICIPALITY OF HALDIMAND NORFOLK **(con't)**		
REGIONAL MUNICIPALITY OF HALTON Contact Person Ho Wing, Manager of Policy Research and Planning Services Tel: (416) 827-2151 ext. 240	• 4 TRS-80 Model II 64K RAM • 2 External 480K disk drives • 1 TRS-80, Daisywheel II printer • 1 TRS-80, DMP-400 dot matrix printer • 1 TRS-80, DMP-410 daisywheel printer • 1 TRS-80, 11' x 17' digitizer • 1 TRS-80, 7' x 10' multipen 6 Colour Flat-bed plotter • 1 TRS-80, single colour roller plotter • 1 Digitial terminal linked to MTC mainframe IBM 370 • 2 Word Processors Micom 2002 (Leased) • In future will try to establish communication linkages between the micro system and the inhouse minicomputer (Digital VAX 750) and/or the MTC mainframe (IBM 370)	• Profile Plus – micro (7) • Visicalc – micro (5) • Radio Shack Graphics package – micro (8) • Statistical package – micro (3) • Word Processing packages – SCRIPTSIT – micro (6) – DICTIONARY – micro (6) • Transportation planning package TRSTRANS (mini version of MTC's System 33 package) – micro (4) • DATAGRAPH (for black and white graphics directly from VISICALC data files)(8)
REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH Contact Person Lou Lanza, Manager Tel: (416) 526-4153	• 3 Terminals (IBM 3270) connected to city mainframe (Twin IMB 4341) • 3 Word Processing terminals connected to Region's Word Processor (Wang OIS 145) • 3 Wang PC, 1x256K, 2x128K and 3 printers (can also access Region's VS90 computer) • Hewlett Packard graphics terminal • No immediate future plans for additional hardware	• SAS (use City of Toronto facilities – mainframe (3) • Multiplan – micro (5) • Easytrieve – mainframe (7) • SPSS – mainframe (3)

Other Packages/ Programs	In-House Programming	General Information & Comments
		– should only get well documented programs and know the assumptions made in those programs – should try to get assessment or similar data or similar data base first on the computer
• Council Record System	• Library catalogue system • Development application processing system that provides reminders for every part of the process e.g., due dates It is linked with a database and word processing • Computer mapping	• Radio Shack software is more business oriented and chose it (in 1980) because: – relatively large manufacturer – would support their products – software is business oriented – other systems (eg, IBM PC and Apple MacIntosh not yet on market) • Using the computer in the Dept. has achieved: – better understanding of what is going on – better access to information – up-to-date information – staff more productive – provides information to other departments – better service and productivity • Main problems: – breaking down user barrier or resistance • When getting into computerization should consider appropriate micro computers. It is best to start small and grow with it
• System 33 – mainframe (4) • Metro Model – mainframe (11) • Collen Model (retail gravity model developed at University of Toronto) – mainframe (12) • Population Projection Model – mainframe(11)	• In-house programming done for: – systems development – to create data files and information retrieval • Regional systems staff provide user support to planning staff	• Regional Committee which decides computer budget priorities • Computers allow for handling large amounts of complex information • Productivity has increased • Reports prepared faster • 4 people in the Dept. who can program computers • Management is encouraging staff to expand the use of computers • When getting into computers: – start simple – look to other municipalities and their experience – look into communication capability – look for computer compatibility • Generally satisfied

HARDWARE AND SOFTWARE

Municipality	Hardware	Commercial Packages
CITY OF KITCHENER Contact Person Brock Stanley, Director of Planning Tel: (519) 885-7115	• City's mainframe IBM 370 • University of Waterloo mainframe • Word Processor AES Superplex 32K and AES 7130 128K model • In future – IBM PC in various City departments, as well as Mowhawk Data Systems MDS Systems 21	• SAS – mainframe (3) • SPSS – mainframe (3)
CITY OF LONDON Contact Person Jarry Tikalsky, Planning Administrator Long-Term Tel: (519) 679-4980	• Terminal access to City's mainframe. Sperry Univac 1100 • Word Processor Olivetti 231 • Possibility of Sperry work station	• Mapper – leased by City and shared by many departments – mainframe (2)
CITY OF MISSISSAUGA Contact Person Debbie Barret, Manager of Office Services Tel: (416) 279-7600 ext. 319	• 3 UTS 20 terminals linkedto City mainframe Univac 1100 • 5 Word Processors (OIS 145 Wang) linked to mainframe • 1 terminal on order UTS 30 will have processors	• SPSS – mainframe (3) • Mapper – mainframe (2)
TOWN OF NEWCASTLE Contact Person Terry Edwards, Planning Director Tel: (416) 263-2231	• 1 Adam 31 terminal on lease linked to real time data pro (GIAC 800) mainframe • 1 Word Processor AES+ with letter quality printer • Facilities not adequate, need 2 more terminals, a micro, and in-house printer	• Word Processing package for AES – micro (6)

Other Packages/ Programs	**In-House Programming**	**General Information & Comments**
• None	• Time Management program in Basic written for IBM PC at U. of Waterloo	• Effective use made of computers and has provided better service to public • SAS has allowed for better statistical analysis • Saves time on processing an application • Reports updated much faster • Training courses for staff • When getting into computers, should start with a system that can handle word processing and data base • Municipality should explore minicomputers with several work stations as an option
• Retail Simulation Model – mainframe (12) • RISC – mainframe (7)	• Program to access assessment and zoning data Developed by MIS department	• Have used computers effectively, especially the property file system • Concern with lack of knowledge on the part of staff who don't know the potential computer applications • Only the younger staff has had exposure to computers at University • A small municipality should start with word processing
• Access Clerk's Dept. Property Information File • Access Tax and Assessment Rolls on Mainframe to generate mailing lists for public meeting notices	• Development Control Monitoring system • UNIDAS (Clerk's Dept) (being established) It would be a key word index for by-laws, Council resolutions, and reports	• Will be increasing number of terminals in Dept. • Improved efficiency of standardization system of information • Information updated on a daily basis • Level of service and validity of projections has improved • When introducing computers should develop a comprehensive land use data base using in-house expertise and resources • Access to mainframe is restricted sometimes • Planning information base accessed by many city departments and reports generally circulated
• None	• Very little in Fortran	• Started word processing in 1981 • Computer costs are high • To better use the mainframe, will: – establish data files – access and add to assessment information – do modelling and data analysis

HARDWARE AND SOFTWARE

Municipality	Hardware	Commercial Packages
TOWN OF NEWMARKET Contact Person Howard Friedman, Director of Planning Tel: (416) 895-5193	• City's computer MAI Basic 4 with one terminal in the Planning Department	• None
CITY OF OSHAWA Contact Person Tom Mokrzycki, Director, Planning and Development Tel: (416) 725-7351 ext. 363	• 3 terminals ICL with keyboard and screen, no. printer – linked to City mainframe (ICL ME 29) • 2 AES Word Processors • Plans are being made to purchase à micro computer to complement mainframe applications	• None
CITY OF OTTAWA Contact Person Barry Nabatian, Senior Planner Tel: (613) 563-3181	• 3 IBM 3270 terminals hooked up to City's mainframe (IBM 4331) • Lease one Data Max 1100 terminal from Data Max Inc • IV Phase mini (word processor) computer • Lease IBM Display Writer • In future Dept. hopes to purchase a microcomputer	• Scope – mainframe (12)
REGIONAL MUNICIPALITY OF OTTAWA-CARLETON Contact Person Nick Tunnacliffe, Director of Policy and Program Division Tel: (613) 563-2824	• Two terminals connected to Region's mainframe IBM Systems 3 • 2 IBM PC 256K RAM • 1 IBM PC 512K RAM with 20 mg hard disk • 1 IBM PC 512K RAM with 166 mg hard disk	• SPSS – mainframe (3) • Mark IV – mainframe (7) • Population Projection – mainframe (11) • MOTORS – micro (4) • UTPS – mainframe (4)

Other Packages/ Programs	In-House Programming	General Information & Comments
• SAS Assessment File – mini (7)	• Limited, some debugging and minor program changes	• The computer has allowed easy access to data • Municipalities should consider using micros (eg, PC's) with processing capability as well as a link-up to mainframe
• OMIS (Oshawa Municipal Information System) – mainframe (7)	• Limited to operating the OMIS system The source language for OMIS is Cobol. The operating language for OMIS is a custom designed English-like language which is used to maintain and retrieve data for the OMIS.	• Computers have achieved efficiency of staff time. Avoid further staff increase and cost • Concerned about availability of suitable planning programs • Need standardization of equipment • Starting to use computers: – start small – be selective – have a focus – justify cost • Staff commitment and ability to show results also important
• Development Information System. Since 1981 the system upgraded to allow access by property address, owners name, census track, etc. The system contains a number of files on various aspects of urban development – mainframe	• Central area data bank – data storage & retrieval system • Property status file is 20% completed. It will determine the status of various files • Recreation facilities booking system is being developed. Only 5% is completed	• Using computers the department has been able to: – produce more – respond faster to enquiries – provide more accurate information for clients and its own use • Main problems: – too much pressure to develop new systems – limited personnel and hardware capacity – lack of staff knowledge – unreliability of outside information (assessment information) • One staff member has professional training in computers. Other staff are being encouraged to take formal training • To get best value of computers establish first a property related information system • Hire consultants to develop the computer system
• None	• Adapting commercial packages	• The Planning dept. purchased IBM PCs to ensure compatibility with Transportation Division • The major concerns and problems are: – documentation of programs & applications

HARDWARE AND SOFTWARE

Municipality	Hardware	Commercial Packages
REGIONAL MUNICIPALITY OF OTTAWA-CARLETON (con't)	• Word Processing AES C20 system with three work stations	• Lotus 123 – micro (2) • d Base II – micro (7) • Info Star – micro (7) • Milestone – micro (13) – a Project management program • Word Star – micro (6) • Spell Star – micro (6) • Grammitik – micro (6) • Mail Merge – micro (9) • Quickcode – micro (13) – helps programming • Informix – micro (7) • Supercalc 3 – micro (5) • Fortran, Pascal compilers (13) Hope to get: • SAS package for micro • Business graphics software • Software (and a board) to turn IBM PC into a Telidon terminal
REGIONAL MUNICIPALITY OF PEEL Contact Person Kath Bladen, Manager, Socio-Economic Analysis Section Tel: (416) 791-9400 ext. 251	• 2 terminals linked to Region's mini computer (PDP 11/44) • 1 terminal linked to MTC mainframe (IBM VT 131) • Use Datacrown and City of Toronto mainframe computers • DEC VT180 micro – 64K RAM, floppy disks • Access to DEC Rainbow 100 micro computer • Imminent acquisition of a micro computer for transportation planning modelling • Imminent decentralization of 2 Xerox 850 word processing units from Clerk's to Planning department	• SPSS – mainframe (3) • SAS – mainframe (3) • Easytrieve – mainframe (7) • Keypad Editor – mini (6) • RDM (Realtime Data Manager) – mini (7) • Ez-shar – mini (10) – Communications package • NY Plan – mini (5) – Financial spreadsheet modelling • MBASIC – micro (13) • MAGICALC – micro (5) • Wordstar – micro (6) • POLY-XFR – micro (10) • Supercalc 2 – micro (6) • CP/M 86-80 – micro (13)
CITY OF PETERBOROUGH Contact Person John Wood, Director of Planning Tel: (705) 748-8880	• 1 Dumb terminal (Honeywell) linked to City mainframe • 1 micro Hewlett Packard 128K RAM linked to City mainframe • AES Plus Word Processor • Access to Trent University mainframe	• d Base II – micro (7) • Peach Calc – micro (2) • SPSS – mainframe (3)

Other Packages/ Programs	In-House Programming	General Information & Comments
		– length of time required to get familiar with application – strategy issue, relationship to other departments and mainframe – security of hardware and software • Suggestions for getting into computerization: – should rent a machine and experiment with it – start with a small application eg housing starts, street names, lists, agendas, assessment data • Region is looking at long range information system plan. A recent study recommended: – use of a central computer with terminal access in user departments for corporate, and large or medium sized departmental systems – use of micro computers for small departmental systems
• 1979 RISC programs – mainframe (7) • METRO MODEL – mainframe(11) • Cordon Count – mainframe (4) • Transportation package (MTC) – mainframe (4)	• COMPASS – Financial modelling package • In-house programs in Basic and Fortran, eg – transportation sub area model – Cohort survival model	• Made effective use of computers • Main problems are: – need systems that are user oriented • Micros are very applicable to planning applications • SAS is better that SPSS. • Anyone starting to use computers should: – develop a development control application system – buy from a reputable company – involve systems people in purchase – get a machine that can really help – get a good quality printer – contact other municipalities before buying – look for a vendor who is willing to do it on a test basis • Study on office automation carried out for the Region in 1983
• None	• None	• Department programming needs are met by the Civic Data Centre

HARDWARE AND SOFTWARE

Municipality	Hardware	Commercial Packages
CITY OF PETERBOROUGH (con't)	• In future may acquire a printer for the terminal	
TOWN OF PICKERING Contact Person Tony M. Magi, Planning Director Tel: (416) 831-2113	• 1 minicomputer MAI Basic Phase 4 (400) • In future would like to have inhouse word processing and an intelligent terminal	• None
CITY OF SAULT STE. MARIE Contact Person Don McConnell, Planner Tel: (705) 759-5375	• 2 terminals (Data General) connected to City mainframe • 1 Apple III 256K RAM	• Visicalc – micro (5) • PFS – Data Management – micro (7) • Apple Writer3 – micro (6) • Apple Access3 – micro (10) • In future Lotus 123 (when available for Apple)
CITY OF SCARBOROUGH Contact Person Peter Moore, Research Planner Tel: (416) 296-7016	• 8 Word Processors Xerox 860 (one can process data) • 1 micro computer on lease for 1 year Digital Rainbow 100 • 1 dumb terminal hooked up to City mainframe Univac 1100	• Extracto – mainframe (7) • Multiplan – micro (5)
TOWN OF STONEY CREEK Contact Person Mr R. Marini, Planning Director Tel: (416) 643-1261	• 1 VEIP 7201 terminal linked to Town's mainframe • City's mainframe DPS 6/92 • 2 word processors Honeywell VIP 7303 (linked to mainframe) • Mainframe will be updated to DPS 6/92 • One more word processor is comming to Planning Dept. • Quality line printer	• Word processing package from Honeywell – mainframe (6)
REGIONAL MUNICIPALITY OF SUDBURY Contact Person David Hughes, Cartographer Tel: (705) 673-2171	• Region's mainframe (Honeywell DPS6/45 and DPS8/49) • Textronics graphic terminal shared with other dept. • 1 AES word processor shared with other dept.	• SPSS – mainframe (3) • Honeywell software for graphics – mainframe (8) • Info star (7) • Topos (7) and Plus (7) will be operational by December 1984

Other Packages/ Programs	In-House Programming	General Information & Comments
• None	• Program developed by Treasury Dept. to store assessment information	• Computer has been useful primarily in meeting public enquiries, and a tool for planning purposes • Considerable time saved in meeting enquiries • The present equipment is not adequate for Department's need
• None	• Planning Information System (assessment and zoning) • Housing model • Population model – micro (11) • Retail Impact Model (12)	• The Dept. is more efficient since computers can store and maintain large amounts of data • Most people in senior positions are reluctant to use computers • One programmer in the department plus 2 people who took computer courses • Should decide what to use computers for and then decide which software and hardware is needed • City hired a consultant to look into overall direction City is going to take for its computer needs. Study is completed and the equipment is being purchased
• None	• Program to establish data base, to transfer hard copy information to computer file • Program to calculate "Expected Population" of neighbourhoods and communities	• Hired a co-op student to establish housing data base using Multiplan • Four staff members can use computers
• None	• Handled by Treasury Dept.	• Corporate decision to centralize computer facilities • Have more effective use of computer facilities especially word processing • Problem with computer down time • When thinking of using computers should look at word processing first • Not every planner has a need for a microcomputer
• Manor Levelob (3) • Population projections – mainframe (11)	• Property Query System • Zoning Index	• None

HARDWARE AND SOFTWARE

Municipality	Hardware	Commercial Packages
REGIONAL MUNICIPALITY OF SUDBURY **(con't)**	• Two Alpha/Numeric terminals, one shared • Plotter and digitizer (shared)	
CITY OF THUNDER BAY Contact Person Philip Wong, Senior Planner Tel: (807) 623-2711 ext. 2527	• 1 IBM 3270 terminal linked to City mainframe (IBM 4341) • 3 Word Processors 256K RAM • In future may get a micro computer which will connect with IBM mainframe	• APLDI – mainframe (7) • SPSS – mainframe (3) • Easytrieve – mainframe (7) – utility package to extract assessment information • SCSS – mainframe (3) – same as SPSS with on-line feature
CITY OF TORONTO Contact Person Alan Mitchell, Planner Tel: (416) 947-7185	• City's mainframe Amdahl 580/5850 • 4 IBM PC's 256K RAM • Nicolet Zeta 8 plotter	• Motors – micro (4) • Lotus 123 – micro (2) • Visicalc (5) • dBase II – micro (7) • Easywriter – micro (6) • Micro – FCS (7) • Diskette-Librarian – micro (1) • PFS File – micro (7) • PFS Report – micro (10) • IRMA – micro (10) • SAS – mainframe (3) • Extracto – mainframe (7) • Stairs – mainframe (13) • APS – mainframe (13) Advanced Productivity Systems (helps you to write "basic" programs)
METRO TORONTO Contact Person Joe Silva, Research Planner Tel: (416) 947-8130	• 3 CRT 3278 terminals linked to City mainframe Amdahl • 1 IBM PC • 1 IBM 3276 terminal linked to MTC mainframe (IBM 370) • IP Sharp computer facilities • 4 Word Processors (Xerox 860) • In future may acquire IBM mainframe	• SAS – mainframe (3) • GIMMS – mainframe (8) • MOTORS – micro (4) • TPS – mainframe (4) • UTPS – mainframe (4)

Other Packages/ Programs	In-House Programming	General Information & Comments
• Retail Simulation Model – mainframe (12) • Population and Employment Model – mainframe (11)	• Done by systems people to maintain programs	• Still much more can be done on computers • Has achieved: – handling survey data – some research made possible only by using computers • Municipalities thinking of computerization: – should know what you want – seek advice of others in the field • A corporate approach to using computers is better that going alone • Province should assist with converting property related information useful to planners from the assessment tape to floppy disks for use on micros
• HOAS (Housing Occupancy and Analysis Project) – mainframe (3) • RISC – mainframe (7)	• Many programs	• 2 full-time programmers on staff
• TRI907 – mainframe (11) • RISC – mainframe (7) • GRS – mainframe (7) • Cordon Count – mainframe (4) • LUDBM – mainframe (7)	• None	• Nearly 50% of staff can use computers • Two in-house planners who can do programming • A medium-sized municipality should: – establish an employment data base – work with systems people – consider establishing GRS.

HARDWARE AND SOFTWARE

Municipality	Hardware	Commercial Packages
REGIONAL MUNICIPALITY OF WATERLOO Contact Person W.R. Frank Watty, Director of Planning Tel: (519) 885-9494	• University of Waterloo mainframe IBM 370 • Region's Honeywell micro computer 128K RAM • Region's mainframe Honeywell DPS7 • MTC's System 33 • Mini computer, Honeywell 610	• SAS – mainframe (3) • SPSS – mainframe (3) • Spires – mainframe (7) • MOTORS – micro (4) • Noise Analysis Programs
CITY OF WELLAND Contact Person Donald Thorpe, Special Studies Planner Tel: (416) 735-1700 ext. 51	• 1 terminal linked to City's mainframe (IBM System 360)	• None
CITY OF WINDSOR Contact Person Raj Varma, Planner Tel: (519) 255-6281 ext. 6448	• 1 terminal connected to City's mainframe (Univac 11/70) • A Word Processor installed recently	• None

Other Packages/ Programs	**In-House Programming**	**General Information & Comments**
• RISC – mainframe (7) • Retail Impact Model (12)	• Programs to extract info. from regional planning file in addition to using 9 standard RISC programs • Programs to do population employment forecasts • Administration type programs	• Corporate needs. required a micro system that did both word processing and other computer capabilities • Find that using four different facilities (hardware) is not productive • Trying to consolidate various activities in one place – a micro system in the department • Department depends upon Finance Department for programming expertise
• None	• Programs for retrieval purposes, mailing system	• When getting into computers, investigate the system of other municipalities as much as possible • Should also have a competent data processing manager in place to correct the problems and develop custom programs
• None	• Programs to access and manipulate census data • Programs to access assessment information	• Computer is not being fully used. There is much more potential • Major problem in staffing • Planning is still low priority

APPENDIX 4

MUNICIPAL SURVEY INFORMATION

SUMMARY OF COMPUTER APPLICATIONS IN PLANNING

PLANNING APPLICATIONS

Municipality	Data Banking/ Analysis	Modeling & Forecasting
CITY OF BRAMPTON	• Yes	• Yes
CITY OF BURLINGTON	• Assessment, finance and census data is stored on mini computer • Property information system will be put on computer	• None
TOWN OF CALEDON	• Intend to store industrial and commercial site information e.g., type, employment, area, assessment, land use controls, etc, etc.	• None
CITY OF CHATHAM	• Committee of Adjustment information is on IBM PC. • In future, hope to have building, zoning and Committee of Adjustment information on City's mainframe	• None
REGIONAL MUNICIPALITY OF DURHAM	Data Banking • Assessment data • Building permit data • Housing starts • Official Plan amendment, subdivision, zoning and consent activity data • Assisted housing inventory • Industrial land inventory • Tourism operators inventory • Detailed data is stored using d Base • Aggregated data is stored using Lotus (Symphony) Data Analysis • Analysis of lot levies, employment and tourism operators surveys • Specific area transportation analysis using Motors • Summary and tabulation of assessment data • Monitoring of development activity, land availability and planning applications	• Population, Commuting migration, Household and employment forecasts • Labour constraints forecasts • Retail assessment and forecasting • Fiscal impact forecasting • Transportation modelling
COUNTY OF ESSEX	• Tabulation of survey data	• Population projections (done once a year)
CITY OF GUELPH	• Retail data is stored on tape • No data analysis	• Have used computers to model retail system • Prepared population and retail needs forecasts

Mapping & Graphics	Development Control	Admin. & Budget	Word Processing
• None	• Yes	• None	• Yes
• No mapping or graphics yet, but will be acquired in future	• Developing a development control system to monitor applications	• None	• Department's word processing needs are satisfied
• None	• None	• None	• Primary function
• None	• None	• Department's budget on Display Writer system	• 80% of text is handled by word processing • Council reports, O.P. zoning by-laws and Committee of Adjustment reports
• No mapping, but graphics on IBM PC utilizing Symphony	• Monitoring development applications activity (plans of subdivision/condominium, official plan amendments, rezoning and consents)	• Budget monitoring* • Inventory of materials and supplies* • Work program monitoring • Departmental mail Log • Library control* • Indexing of staff reports* * In progress	• Yes
• None	• None	• Monthly budget reports at city's minicomputer	• Reports • Official Plans • Zoning by-law amendments
• Using consultants – Digital mapping for one subdivision in City	• Developing program to prepare circulation lists for zone changes, etc.	• Accounting, budgeting and payroll fully computerized	• Share hardware with other departments

PLANNING APPLICATIONS

Municipality	**Data Banking/ Analysis**	**Modeling & Forecasting**
REGIONAL MUNICIPALITY OF HALDIMAND-NORFOLK	• Assessment information. • Population, housing and severance information • In future hope to develop a data bank of population, employment and industry • Inter-relationship of housing and population	• Population projections • Household Projections
REGIONAL MUNICIPALITY OF HALTON	Data Banking (MTC mainframe) • Assessment data • Environmental field data (Micro computer) • Data on subdivisions, condominiums, consents, O.P. & by-laws • Monitoring staff time, project status • Census data • Developing data banking for bldg. permit system Data Analysis • Manipulation of information to produce desired reports • Policy review by monitoring status of various development files	• Transportation modelling • Population projections
REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH	Data Banking • Property related assessment information – zoning code – planning divisions – land use • Industrial information system – property characteristics – building characteristics – establishment characteristics • Employment survey data (1982) – inventory • Transportation data • Commercial land inventory – retail space – office space – com. related parking • Statistics Canada data Data Analysis • Limited to simple manipulation to produce crosstabs, etc. • Use SAS analysis of industrial information for council reports • Multiplan for analysis of commercial data	• Population forecasting • Retail modelling • Transportation modelling

Mapping & Graphics	Development Control	Admin. & Budget	Word Processing
• Very limited. Have used U. of Waterloo for some graphic work	• Severance file • Address labels	• Library list • Mailing list	• Recently acquired
• Graphics package to produce line graphs, bar charts, pie charts and thematic maps • Mapping of regional plan policy areas (using different overlays to show various combinations of policy areas)	• Development application processing system monitors all kinds of development applications	• Budget update • Following lists – library – Planning Dept. file – mailing lists – inventory of published reports • Staff reports • Map originals • Computer printouts	• Yes
• SAS Graphs • Colour graphs for reports (Hewlett Packard) • No mapping yet. Hope to digitize Region's maps. Census tracts have already been digitized	• Zoning notification • Management information system for subdivision and condominium development records	• Done by Finance Department • Staff time management system	• Meeting current requirements, but demand is increasing • Only used for report production and not for memos or letters

PLANNING APPLICATIONS

Municipality	Data Banking/ Analysis	Modeling & Forecasting
CITY OF KITCHENER	Data Banking • Assessment information • Developing a data base for 5 neighbourhoods; includes: – age – land use – condition – zoning – ownership – major & local streets – obnoxious use – railway tracks Data Analysis • Cross tabulations • Statistical summaries • Statistical analysis • Time management	• None
CITY OF LONDON	• Assessment and zoning information • Retail data (not being updated regularly) • Some rudimentary analysis of data to produce reports • RISC, possible future analysis of assessment data	• Retail modelling, a gravity based model. Not active at present
CITY OF MISSISSAUGA	• Rezoning application file • Subdivision application file • Site plan application file • Registered plan file • Planning district file • Rezoning by-law cross-reference file • Name cross-reference file • Data resulting from development control activity, population, employment and housing studies • On-line inquiry/update and manipulation of data files in the monitoring control system via terminals	• Transportation modelling • Population projections
TOWN OF NEWCASTLE	• Assessment Data – lot frontage – area – owners – name – mailing address	• None

Mapping & Graphics	**Development Control**	**Admin. & Budget**	**Word Processing**
• None	• Address labels	• Time sheets • Circulation lists • File system	• Present demand is satisfied • In future would like to access Committee of Adjustment decisions by street address, application type, land use type, etc.
• None	• Application monitoring system allows creation, updating and monitoring of all development applications	• Address labels	• Only for reports, letters, memos, etc. still done on typewriter • Need another word processing unit
• Consultants engaged to undertake feasibility study of land related information systems. Study will involve all city depts. and address the horizontal control networks data base management, and computer graphics • Will have access to a DEC Rainbow with colour monitor and plotter for business graphics in late 1984	• Comprehensive development control monitoring system used to track all applications • Wide variety of reports generated from data bank of developers' names and addresses to status of development	• Statistics for annual review generated from development control monitoring system • Use General Ledger accounting system on mainframe for monthly budget review and Mapper package on mainframe to input annual budget data	• Used to prepare all staff reports, studies, correspondence, by-laws, and committee agendas and minutes • Interface with external printing house to typeset the official plan, zoning by-law, special studies, revisions and consolidations • Interface with City departments located in another building to transmit reports and information
• None	• Zoning, O.P. amendments, subdivision severance, and minor variance files	• None	• Yes

PLANNING APPLICATIONS

Municipality	Data Banking/ Analysis	Modeling & Forecasting
TOWN OF NEWCASTLE (con't)	– street number – lot and concession – plan number – occupancy • Would like to have: – industrial and commercial floor area – employment data	
TOWN OF NEWMARKET	• Assessment File – zoning – Official Plan – minor variance etc.	• None
CITY OF OSHAWA	Data Banking • OMIS contains – zoning – lot dimensions – land use – tenure – geo-code for each property – dwelling unit count – assessment data • In future: – commercial data – building data – industrial data Data Analysis • Aggregation of data by individually defined polygons • Some mathematical manipulations	• None
CITY OF OTTAWA	• Master address file by property address by: – census track – ward – planning district – block – owner – name – zoning – land use • Business and residential unit files are being developed. File will contain: – owner – tenant – type of business – floor area – no. of rooms • In future property data file will contain:	• Retail modelling using "scope" program

Mapping & Graphics	Development Control	Admin. & Budget	Word Processing
• None	• None	• None	• None
• None	• Building permit summaries on AES • The department maintains Status reports on rezoning and subdivision applications on AES	• Department's budget is on AES	• 80% of Dept's needs are being met • Committee of Adjustment submissions and decisions are also kept on word processing
• None	• Property status file being developed to update: – subdivisions – severance – demolition applications	• Handled by Finance Department • Address labels	• IV Phase mini computer is handling 80% of Department's needs

PLANNING APPLICATIONS

Municipality	Data Banking/ Analysis	Modeling & Forecasting
CITY OF OTTAWA (con't)	– building permits issued – zoning history – Committee of Adjustment history – violation and order history – site plan history – demolition history • This will be completed by 1984 It will be on-line system with City mainframe • Individual data in various file can be analyzed to produce custom made reports	
REGIONAL MUNICIPALITY OF OTTAWA-CARLETON	Data Files: • Census data • Assessment information • CMHC housing data • Subdivision application data • Data on vacant lots • Survey data (eg employment, housing, public participation) • Vacant, industrial and residential land inventory • Severance data Data Analysis: • Monitoring system (will be put on micro in future) • Mainframe processes survey data (in future will be done on micro) • Micro will be used for extraction of data from mainframes for local analysis and summary reports	• Demographic and economic projections • Transportation modelling
REGIONAL MUNICIPALITY OF PEEL	Data Banking • Socio economic data • Demographic • Land use • Resource data • Administrative records • Projected data • Rental inventory – rents by building – geared to income – average rent by type of building per year • Subdivision, condominium data • Employment survey data • 1981 Census Data Analysis • Data base management	• Travel demand forecasting • Population, employment, housing projections • Regional budget Projections (assessment base)

Mapping & Graphics	Development Control	Admin. & Budget	Word Processing
• Very limited capabilities in this area • Thematic mapping and business graphics in future	• Subdivision status system now on mainframe will be on micro • Now developing – local O.P. status system – condominium status system – severance status system – zoning status – list of all street names	• Time reporting system • File lists • Library accessing list • In future: – Library card catalogue (micro) – order-out file – serials master record – libraries and publishers mailing lists – index of visuals – publications list – form letters merged with status file – budget automated on the mainframe. • Terminal access available but poor	• 80% of word processing needs met by AES and IBM PC. • All word processing requirements will be met in two years • Word processing/typesetter link is anticipated in future • Training for managers and technical staff to do word processing anticipated
• Use City of Toronto computer for graphics and mapping	• Development Control inventory on the PDP 11/44	Planned for 1985: • Work Program on word processing • Project management using data base software on Rainbow 100	• Two Xerox 850 units to be decentralized from Clerk's to Planning in the 3rd quarter, 1984

PLANNING APPLICATIONS

Municipality	Data Banking/ Analysis	Modeling & Forecasting
REGIONAL MUNICIPALITY OF PEEL (con't)	– summary reports – transfer of data files between various computers – statistical analysis of data – cross tabulations • Sampling Frame maintained	
CITY OF PETERBOROUGH	Data Banking • Assessment data – roll number – property status – property condition – size and property tax information • Building permit data – owner, address – construction value – type of construction • In future trying to establish a planning file on mainframe – information such as housing costs, commercial data, zoning information would be included Data Analysis • Analysis of survey data to produce summary reports and graphics using micro • Analyze housing study survey information	• None
TOWN OF PICKERING	• Assessment data – owners' name – property address – area and unit class • Planning data • The above information can be retrieved for 15,000 properties. Has been in place since January 1983	• None
CITY OF SAULT STE. MARIE	Data Banking • Planning information system. Planning file contains: – ward and poll – map number – neighbourhood code – enumeration area – zoning data – historic site designation – fill regulation designation – standard industrial classification – number of residential units – application number	• Population and employment forecasts • Retail impact of development applications • Housing model

Mapping & Graphics	Development Control	Admin. & Budget	Word Processing
• Only some graphics using a package on the Hewlett Packard	• None	• None	• Form letters, limited mailing labels
• None	• None	• None	• None
• None	• Development application number and relevant info. is added to planning information system • Processing applications still manual	• Address labels	• Use Apple III for major reports • Entire O.P. is on Apple disk

PLANNING APPLICATIONS

Municipality	Data Banking/ Analysis	Modeling & Forecasting
CITY OF SAULT STE. MARIE (con't)	• Assessment file: – roll number – owners name – other • Housing survey information • Communications with other data bases e.g. Infoglobe, Telidon, Cansim • Customized report production	
CITY OF SCARBOROUGH	• Assessment information • Commercial and housing data bases • Summary reports • Statistical analysis on census data is carried out	• Some modelling was done i Scarborough Transportatio Corridor Study
TOWN OF STONEY CREEK	Data Banking • Assessment information – owners name – Committee of Adjustment – parcel size – number of occupants – zoning – other by-laws • In future, industrial land inventory on word processor Data Analysis • No computer assisted analysis at present • Hope to develop electronic perpetual calendar to alert various deadlines • Hope to manipulate assessment information in future	• None
REGIONAL MUNICIPALITY OF SUDBURY	• Commercial land inventory • Street index • Land use index • Industrial land inventory • Multiple listing service • Building permits (building starts and completions)	• Population Cohorts model
CITY OF THUNDER BAY	• Assessment data – roll numbers – address – owner's name – property information – tax information • Industry inventory file (created in 1982) Use APLDI to extract data • Vacant lot inventory by type	• Retail modelling • Population and employmer forecasting using Sault Ste Marie model • Cohort Survival model from U of Waterloo

Mapping & Graphics	Development Control	Admin. & Budget	Word Processing
• None	• Progress of development applications is listed and updated on word processors	• Time management system for two divisions	• Word processors are being effectively used
• Investigating digital mapping	• Official Plan & zoning by-law information will be stored on word processor	• Circulation labels • Treasury Dept. handles monthly statements on mainframe	• Almost 100% of Department's needs are being met
• Thematic mapping will soon be operational	• Property query • Zoning Index	• None	• Reports, by-laws and Official Plan information done on word processor
• None	• Monitoring of subdivision activity. Status of files can be reviewed	• Circulation lists	• 90% of text manipulation needs are met

PLANNING APPLICATIONS

Municipality	Data Banking/ Analysis	Modeling & Forecasting
CITY OF THUNDER BAY (con't)	• For data analysis APLDI package is used. It can manipulate 22 different functions or variables	
CITY OF TORONTO	Data Banking • Central Property Register: – finance – buildings and inspections – public works – Teela Market Study – planning and development – public health – parks and recreation • Data files: – employment – traffic counts – all in-house data (surveys) – income – recreation inventory – industry directory – Cansim – 1971, 1976 and 1981 census stats – Provincial Driver Registration Data Analysis • Surveys conducted by in-house and outside consulting firms	• Population, housing occupancy, employment, land use and transportation forecasting • Economics and Time Series using SAS/ETS
METRO TORONTO	Data Banking • Land use • Employment • Income • Floor area (commercial) • Office data • Census data • Assessment data • Developing commecial data base.	• Land use data base • Forecasted values for: – Land use – employment – housing – population • Traffic modelling using UTPS and TPS
REGIONAL MUNICIPALITY OF WATERLOO	Data Banking: • Assessment information • Environmental data bank • Waterloo Regional Interactive Environmental Database (WRIED) Data Analysis: • RISC • SAS • Environmental data banks and Spires to assess impact of development applications in sensitive areas	• Retail modelling impact of new proposals on existing commercial developments • Cohort Survival modelling • Transportation modelling

Mapping & Graphics	**Development Control**	**Admin. & Budget**	**Word Processing**
• Business graphics and mapping • SAS/GRAPH	• Processing of zoning applications, their status, instrument numbers for development agreements, site plan control applications, City Clerk's residential demolition applications, building permits, and condominium-conversion applications	• Handled in Computer Services Division of Management Services Department	• 100% done on ATMS mainframe – Easywriter – FSP (SAS) for planner memos short reports etc.
• Have the capability, but not done much at present. • Transportation networks and assignments plotted on CALCOMP plotter.	• None	• None	• Yes
• None	• Distribution labels produced by Finance Dept's computer • Hope to use new micro computer for monitoring development applications	• Time management activity	• Recent acquisition of Honeywell DPS 6/10 system will allow full word processing capabilities

PLANNING APPLICATIONS

Municipality	Data Banking/ Analysis	Modeling & Forecasting
REGIONAL MUNICIPALITY OF WATERLOO (con't)	• Point map data bank information is used to analyze to help determine land suitability for various uses – residential, industrial, recreation, agriculture, etc.	
CITY OF WELLAND	• Assessment information – property address – legal description – site dimensions and area – owner and mailing address – names of tenants – age groupings and building information • Industrial retrieval system for properties zoned or used for industrial purposes: – zoning – O.P. designation – map numbers – available servicing – building size and access • In future – developing and implementing a complimentary system containing planning information for every property in municipality	• None
CITY OF WINDSOR	• Creation of a property related data base is in progress • In process of geo-coding and hope to be completed by end of the year • Demographic analysis • Analysis of assessment data	• None

Mapping & Graphics	Development Control	Admin. & Budget	Word Processing
• None	• Mailing system for public notification of rezonings, official plan amendments, Committee of Adjustment applications	• Address labels	• Share with Treasury Dept. on an IBM Word Processor
• None	• Up-to-date information on Official Plan, zoning, site planning control • File used to produce status reports	• Budget control via terminal • Staff time control via terminal	• Used for all planning report production

APPENDIX 5

DIRECTORY OF COMPUTER SOFTWARE

INTRODUCTION

The program listings in this Directory are organized according to their prescribed categories. Both general purpose and applications software programs are included. Each program listing provides the program name and category, the producer's name and address, a description of the functions of the program, the operating system and memory required to run the program, and the program price, if available. The memory required is listed in terms of kilobytes of RAM. The operating system includes both the hardware required to use the program (such as a colour graphics adapter, modem, printer, etc.) and the actual operating system under which the program runs (such as CP/M or the UCSD p-system). An important note with respect to the operating systems listed is that PC-DOS and MS-DOS are interchangeable names for the same system, while Apple DOS is a separate system.

Popular spreadsheet programs such as Lotus 1-2-3 and Symphony are listed under the Integrated Packages category.

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- VisiWord
- Volkswriter
- Wordstar

COMMUNICATIONS

Name of package	Brief Description	Operating Requirements	Source and Price
APPLE ACCESS 3	For details contact the City of Sault Ste. Marie.		
ASCII EXPRESS	This program works with a number of modems on the market, and performs the standard telecommunications operations, such as transfer of data between computers.	Apple DOS, 64K	Southwestern Data Systems; $129 (U.S.)
ASCOM	This program enables the IBM-PC to transmit and receive information, via a modem. There is a wide range of options.	PC-DOS, 64K	Dynamic Microprocessor Association 545 Fifth Avenue New York, New York 10017 U.S.A.; $175 (U.S.)
COMPUSERVE	This is a subscription service which can be accessed using a modem, and for which there is an hourly fee. It offers electronic mail, catalog shopping, word processing, and over 1200 other functions. There is a user manual included, and extensive help menus are available.	PC-DOS modem 64K	Compuserve, Inc. 5000 Arlington Centre Building Columbus, Ohio 43220 U.S.A.; $39.95 + $6/hr. (U.S.)
CROSS TALK	Cross Talk is a communications program that can transfer files between computers, as well as operate microcomputers at remote locations. The program is command-driven.	CP/M - 80, MS-DOS, 64K	Microstuf 1845 The Exchange, #140 Atlanta, Georgia 30339 U.S.A.; $195 (U.S.)
DATA CAPTURE	This program allows the capture of data files from other computers, as well as providing exceptional control over the printer. The program is menu-driven.	Apple DOS, MS-DOS, 64K	Southeastern Software; $120 (U.S.)
EZSHAR	For details contact the Regional Municipality of Peel.		
IBM COMMUNICATIONS SUPPORT	This program allows the IBM-PC to transmit and receive BASIC files, via a modem facility.	PC-DOS, 64K	IBM Systems Products Division P.O. Box 1328 Boca Raton, Florida 33432 U.S.A.; $40 (U.S.)
IRMA	For details contact the City of Toronto.		
PC NET	For details contact the Regional Municipality of Durham.		
PC-TALK III	This is basically a public domain program which performs the standard telecommunications operations of sending files, mail, etc.	MS-DOS, 64K	Headlands Press; $35 (U.S.)
PFS-REPORT	For details contact the City of Toronto.		

COMMUNICATIONS

Name of package	Brief Description	Operating Requirements	Source and Price
POLY-FXR	For details contact the Regional Municipality of Peel.		
SOFTERM	This is a terminal emulation program which allows the Apple to emulate a number of different terminals. It thus allows access to mainframe computers.	Apple DOS, 48K	Softronics 36 Homestead Lane Roosevelt, New Jersey 08555 U.S.A.; $150 (U.S.)
THE SOURCE	The Source is a database and electronic mail service. It provides stock market information, news (by keyword), travel and employment data, and many other databases of interest.	available for most micros, memory requirement not known.	Source Telecomputing Corporation 1616 Anderson Road McLean, Virginia 22102 U.S.A.; $100 (U.S.) + user fees

DATABASE MANAGEMENT

Name of package	Brief Description	Operating Requirements	Source and Price
APLD1	For details contact the City of Thunder Bay.		
CONDOR 3	This is a fully relational database manager that includes multiple file capability through a file manager routine which permits management, inquiry and reporting.	CP/M, 64K	Condor Business Systems 2051 S. State Street Ann Arbor, Michigan 48104 U.S.A.; $995 (U.S.)
dBASE II	This is a relational database system, with extensive sorting features, multi-level searches and built-in applications development. There is a limited report generator. Files contain up to 65,535 records, each having 35 fields of up to 254 characters. A disk tutorial and user manual are included with this command-driven program. An updated version is available in the dBASE III package.	CP/M, 48K	Ashton-Tate 9929 Jefferson Avenue Culver City, California 90230 U.S.A.; $700 (U.S.)
dBASE ENHANCEMENT	For details contact the Regional Municipality of Durham.		
DB MASTER	This is a comprehensive database management system with password protection and extensive report creation options. Up to 1,000 characters per record are permitted.	available for most micros, memory requirement unknown.	Stoneware 50 Belvedere Street San Rafael, California U.S.A.; $229 (U.S.)
EASYTRIEVE	For details contact the Regional Municipality of Hamilton-Wentworth.		
EASY FILER	Easy Filer is a menu-driven database program that can hold 500 records, with fifty fields per record. A template for laying out the field can be created. The program can search sound-alike names.	MS-DOS, 64K	Information Unlimited Software Inc. $400 (U.S.)

DATABASE MANAGEMENT

Name of package	Brief Description	Operating Requirements	Source and Price
EXTRACTO	For details contact the City of Scarborough.		
GENERAL MANAGER	This is a user-definable data management system. One can change the screen and field format without re-entering data.	available for most micros, memory requirement unknown.	Sierra On-Line Sierra On-Line Building Coarsegold, California 93614 U.S.A.; $229 (U.S.)
INFORMIX	For details contact the Regional Municipality of Ottawa-Carleton.		
INFOSTAR	This is a database management system for non-programmers. It maintains and updates files, and generates preset or customized reports.	CP/M, memory requirement unknown	Micro Pro 33 San Pablo Avenue San Rafael, California 94093 U.S.A.; $495 (U.S.)
MARK IV	For details contact the Regional Municipality of Ottawa-Carleton.		
PFS - DATA MANAGEMENT	For details contact the City of Sault Ste. Marie.		
PFS - FILE	This is a database management system in which the user controls the data in a totally unstructured database. The program is adept at file handling operations. Copying of selected information between files is possible. The Search/Update feature allows retrieval of user-defined information categories. Removal of selected data is also possible.	available for most micros, 64K	Software Publishing 1901 Landings Drive Mountain View, California U.S.A. 94093; $125 (U.S.)
PROFILE PLUS	For details contact the Regional Municipality of Halton.		
REALTIME DATA MANAGER (RDM)	For details contact the Regional Municipality of Peel.		
SPIRES	For details contact the Regional Municipality of Waterloo.		
TIM	For details contact the City of Chatham.		
TOPOS	For details contact the Regional Municipality of Sudbury.		
VISIFILE	This is a database management system for organization and retrieval of information, allowing sorting and modification of records. A maximum of 32,000 records can be stored in each file. With 128K of memory or more, up to 104 fields per record, 2040 characters per record are allowed and 18 indices are possible.	available for most micros, 64K-128K	Visi Corp 2895 Tanker Road San Jose, California 95134 U.S.A.; $250 (U.S.)

FISCAL/FINANCIAL IMPACT ANALYSIS

Name of package	Brief Description	Operating Requirements	Source and Price
DECISION TREE PROGRAM	This is a sequential decision model, which can analyze a variety of decision chains and calculate the income or cost associated with each action. Output from the program takes the form of decision tables; present value can also be determined.	Apple DOS, 48K	'Executive Planning with BASIC' by X.T. Bui published in book form by Sybex, Inc., 1983; price N/A.
DIM	The Development Impact Model (DIM) summarizes and documents the results of initial market and land planning, and performs an analysis of financial feasibility. As such, considerable analysis is required before DIM may be run: market and land use planning data are needed as inputs to the program, which then can analyze a wide variety of development scenarios.	mainframe, memory requirement N/A	John Rahenkamp and Associates Inc. Philadelphia, Pennsylvania U.S.A.; price N/A
FISCAL ADVISOR	The program can be used to assess development proposals, annexations, or the economic feasibility of a comprehensive plan. To examine the fiscal effects of a new subdivision, for example, Fiscal Advisor can forecast several years of revenue and expenses that would be incurred by the local government. The program could factor in the number of people per household, the number of children, the price per housing unit, and so on. The program can analyze the possible mix of services, the cost of capital improvements and the various fiscal consequences of development projects. These calculations may be performed for residential, commercial, industrial or institutional developments. Fiscal Advisor can be customized for specific applications: the cost would vary according to the work involved.	Apple DOS, 64K	N. Sipe/H. Fishkind Bureau of Economic and Business Research University of Florida Gainesville, Florida 32611 U.S.A.; $500 (U.S.)
LGAMAINT	This is a maintenance forecasting model for estimating the forward financial requirements of a maintenance programme for physical assets or facilities.	dBase II and Lotus 1-2-3, 192K, printer, 1 disk drive	The Chief Division of Building Branch, CSIRO P.O. Box 56 Highett, Victoria, 3190 Australia; price N/A
MUNIES, FISCALS, CIPS	MUNIES and FISCALS are fiscal impact analysis programs. They can be used for planning, budgeting and management. Database management and cash flow manipulations are made possible by the incorporation of matrices. CIPS programs capital improvements, and may save up to a	any micro with a FORTRAN compiler or mainframe	Tischler, Montasser & Associates 1000 Vermont Avenue Northwest Washington, D.C. 20005 U.S.A.; $19,900-$49,900 (U.S.)

FISCAL/FINANCIAL IMPACT ANALYSIS

Name of package	**Brief Description**	**Operating Requirements**	**Source and Price**
MUNIES, FISCALS, CIPS **(con't)**	half-year in labour costs, if capital improvement programming has been an ongoing activity involving several people. Between 4 and 15 days of professional support time are included, during which applicability of local data is checked. Back-up includes detailed training manuals and a telephone hotline. The three programs can meet the needs of any community.		

GEOGRAPHIC INFORMATION SYSTEMS

Name of package	**Brief Description**	**Operating Requirements**	**Source and Price**
COMMERCIAL AND INDUSTRIAL FLOORSPACE SYSTEM (CIFS)	CIFS stores and manipulates geographically coded data on individual buildings. It may be run with the LUIS system (Land Use Information System) to display and consolidate date.	mainframe DEC PDP 11/70 + RST5/E Operating System memory requirement N/A	Greater Vancouver Regional District 2294 West 10th Avenue Vancouver, British Columbia V6K 2H9; price nil
DEMOSCAN	DemoScan consists of report generation and data manipulation utilities to produce demographic summaries for user-defined geographic areas. Input data includes census data and user input data. Output includes a choice of six standard report formats, or flexible custom formatting. Summary measures available are counts, percentages, indices and cumulative values. A single report may contain up to 500 geo-units and 10 volumes of data. DemoScan was designed for ease of use by non-programmers and non-data processors. The program is menu-driven. Data utilities include selecting geo-units for processing, aggregating data across geo-units, and inputting new data.	Apple II: UCSD p-system Apple II: 64K IBM-PC: 128K	Keith Satter Claritas Corporation 1911 N. Fort Myer Drive Arlington, Virginia 22209 U.S.A.; price N/A
DIGITIZER INTERFACE PROGRAM	This program provides the interface between a digitizer and microcomputer, and the resulting geo-coded data can be used in a number of planning applications. These include: • using input to create a land use file • computing areas by land use type and by zone • computing runoffs into bodies of water	TI 99/4A micro, memory requirement N/A	Michael Waller Little Rock Metroplan Wallace Building - 8th Floor 105 Main Street Little Rock, Arkansas 72201 U.S.A.; price N/A

GEOGRAPHIC INFORMATION SYSTEMS

Name of package	Brief Description	Operating Requirements	Source and Price
DIGITIZER INTERFACE PROGRAM **(con't)**	• printing and plotting geo-coded data. The program requires: • Texas Instruments Hi-PAS Digitizer • RS-232 Interface		
IBIS	IBIS is an interactive program which can: • store and retrieve large amounts of data • generate and combine data • perform analyses on the data • display data and results. The program works on a grid system, in which data is processed for cells within a study area. This allows construction of a variety of planning models, particularly for environmental planning application.	mainframe adapted to Apple micros memory requirement N/A	College of Architecture and Planning Ball State University Muncie, Indiana U.S.A.; price N/A
LAND USE INFORMATION SYSTEM (LUIS)	LUIS stores, displays and interrelates geographically coded data (e.g. demographic or land use data).	mainframe DEC PDP 11/70 + RSTS/E Operating System memory requirement N/A	Greater Vancouver Regional District 2294 West 10th Avenue Vancouver, British Columbia V6K 2H9; price N/A
QUERRY	This program can link information between Statistics Canada files and assessment files to create desired sets of information, especially socio-economic data. The program can then perform a variety of data analyses, and manipulations, including cross tabulations.	PDP 11 mainframes, memory requirement N/A	Berron Research Suite 109 310 Bagot Street Kingston, Ontario K7K 3B5 (613) 549-7876; price N/A

GRAPHICS

Name of package	Brief Description	Operating Requirements	Source and Price
APPLE II BUSINESS GRAPHICS	This package converts numerical data into charts and graphs. It features mathematical and statistical functions.	Apple DOS, 64K	Apple Computer, Inc. 20525 Mariani Avenue Cupertino, California 95014 U.S.A.; $175 (U.S.)
CADPlan	CADPlan creates two dimensional designs. A database manager maintains statistics on design components. Designs are created with either pen and tablet, a mouse, or a digitizer. Designers may 'pan' around the design for a better view, or 'zoom in or out' to check details. Lines may be solid, dashes or dots, and may be in three colours. The program requires a disk drive, colour graphics adapter, and a mouse or pen or digitizer.	PC-DOS, 256K	Personal CAD Systems 15425 Los Gatos Blvd. Los Gatos, California 95030 U.S.A.; $1200 (U.S.)

GRAPHICS

Name of package	Brief Description	Operating Requirements	Source and Price
AUTO CAD	Auto CAD is a 2-D program capable of drawing anything from simple flow charts to complex architectural drawings. Features include a wide range of primitive commands, floating-point accuracy, few limits on drawing size, good memory management, good peripheral support and thorough editing abilities. User-definable menus, macros and command files are also included. One drawback is that editing, zooming and panning become slower as the drawing size increases. Use of the Intel 8087 compressor can speed the program's operation. The program is updated regularly.	MS-DOS/CP/M available for most micros 256K	Autodesk, Inc. 150 Shoreline Highway Building B Mill Valley, California 94941 U.S.A.; $1000/1500 (U.S.), depending on machine
CHARTMAN	Chartman is a graphics package available in five versions. Chartman I generates two- or three-dimensional monochrome graphics. Twenty chart formats can be designed. Chartman II displays colour graphics, while Chartman III allows users to design 12 chart types, including line graphics, and pie, bar, text and 3-D charts. Chartman IV offers a set of formats including Gantt, organizational, area fill, and on-screen text charts, scattergrams and statistical curve fitting. Super-Chartman II displays data in 25 chart formats. Data may be moved between charts, and up to six may be printed on one sheet of paper. The program requires two disk drives and colour graphics adapter.	PC-DOS, 128K	Graphic Software, Inc. 1972 Massachusetts Avenue Cambridge, Massachusetts 02140 U.S.A.; $199-500 (U.S.) depending on model chosen.
CHART-MASTER	Chart-Master produces bar, line scatter and pie charts, and can create up to nine charts per page. It can use data from VisiCalc, DIF or user-created files. Text-processing features are included. The program is menu-driven, and provides extensive defaults for creating standard charts.	PC-DOS, Apple DOS, Apple SOS, 64K	Decision Resources, Inc. 21 Bridge Square Westport, Connecticut 06880 U.S.A.; $375 (U.S.)
DATAGRAPH	For details contact the Regional Municipality of Halton.		
E-Z DRAW	A graphics program that produces rectangles, triangles, parallelograms, circles, ellipses, and allows these shapes to be filled with colour or text.	Apple DOS, 48K	Sirius Software 2011 Arden Way Sacramento, California 95825 U.S.A.; $45 (U.S.)

GRAPHICS

Name of package	Brief Description	Operating Requirements	Source and Price
GIMMS	This is a package capable of creating and displaying maps and standard graphics, as well as doing some geographic analysis on the data employed in the program. The program is written in FORTRAN, and is sold with a users' manual and test data.	mainframe, memory requirement N/A	GIMMS Limited 30 Keir Street Edinburgh, EH3 9E2 U.K.; price N/A
GRAPHICS PACKAGE FOR RADIO SHACK	For details contact the Regional Municipality of Halton.		
HONEYWELL GRAPHICS PACKAGE	For details contact the Regional Municipality of Sudbury.		
MCS 3-D SPACE TABLET	MCS is a three-dimensional modelling package complete with a special digitizer that allows three-dimensional data entry. A 3-D stick figure can be digitized, rotated, edited and rescaled on the monitor. The program also allows two-dimensional digitizer input, which can then be transformed to 3-D with a high degree of accuracy.	MS-DOS, memory requirement N/A	Micro Control Systems Inc. 143 Tunnel Road Vernon, Connecticut 06066 U.S.A.; price N/A
MICROPLAN	This is a package of 19 easy-to-use programs which can: • produce plans and maps • overlay 2 and 3-D symbols, histograms and pie charts • draw 2 and 3-D images, including perspectives, scaling, rotation, superimposition • annotate images with lettering, symbols, keys, shading, etc. • measure parts of images, distances, areas and volumes • digitize map coordinates, boundaries, plans • produce diagrams to report-quality standard.	available for several micros, memory requirement N/A	MVA Systematica 112 The Strand London, WC2R 0AA U.K.; price N/A
PFS - GRAPH	PFS - Graph is a simple graph generator, which produces pie charts, bar graphs and line graphs. Graphs can be displayed on the screen or printer, in monochrome or colour. The program requires two disk drives.	SOS/Apple DOS 3.3, 64K (Apple II), 128K (Apple III)	Software Publishing Corp. 1901 Landings Drive Mountainview, California U.S.A. 94043; $125 - Apple II, $175 - Apple III (U.S.)
THE PRIME PLOTTER	This is a graphics package with statistics and data analysis features. It has been designed as a modular system to allow addition of applications. The program accepts DIF files created by VisiCalc, and performs X-Y and pie plotting, curvefit regressions, distribution and trend analysis.	Apple DOS 3.3 Apple II+/IIe, 64K	Primesoft Corp. P.O. Box 40 Cabin John, Maryland 20818 U.S.A.; $240 (U.S.)

GRAPHICS

Name of package	Brief Description	Operating Requirements	Source and Price
3 DESIGN	This is a three-dimensional stick-modelling package that constructs images as a collection of polygons. Features include hidden-line removal and coloured surface shading. The package is updated regularly.	MS-DOS, memory requirement N/A	3 Design POB C-56789 4710 University Way Northeast Suite 1512 Seattle, Washington 98105 U.S.A.; under $300 (U.S.)
VERSA CAD/CAD APPLE	These are two different versions of a 2-D CAD program. The program's ability to overflow a drawing to the disk eliminates the problem of being limited by the available RAM. Rich primitives, including a Bezier curve-fitting provision, good editing features, the ability to save views, a screen-dump provision and partial deletion of drawing elements are features of the program. The program can require two monitors, and supports a variety of peripherals. There is an optional 3-D interface available.	MS-DOS/Apple DOS, 64/128K	T & W Systems, Inc. 7372 Prince Drive Suite 06 Huntington Beach, California 92647 U.S.A.; $1995 (U.S.)
VISITREND/PLOT	This is a business graphics program that produces pie, bar and high-low-close charts and X-Y plots. It also performs statistical analysis and forecasting.	Apple DOS, Apple SOS, PC-DOS two disk drives 128K	VisiCorp 2895 Zanker Road San Jose, California 95134 U.S.A.; $300 (U.S.)

INTEGRATED PACKAGES

Name of package	Brief Description	Operating Requirements	Source and Price
ACOMPANI	A comprehensive planning package, which can perform seven operations, including 35 types of statistical analysis, production of two-dimensional maps and graphs, and production of reports, including text and graphics. Acompani can perform a variety of planning tasks. It can perform an inventory of land uses in a particular location, an evironmental analysis by generating maps (e.g. plotting soil types to finalize the best place for a development). It can do locational analysis - compiling hazards, or incidents of crime, for example.	Tektronix 4050 - series micros only, memory requirement N/A	Bob Lima Division of Architecture Texas Tech University Lubbock, Texas 79409 U.S.A.; $5000 (U.S.) for 1st year, negotiated price thereafter
ENCORE!	A financial modelling package which combines spreadsheet analysis with graphics and a systems development program. Logic and statistics functions are included. The program produces bar charts, pie charts and scatter graphs.	PC-DOS hard disk printer 256K	Ferox Microsystems Inc. 1701 North Fort Myer Drive, #611 Arlington Virginia 22209 U.S.A.; $1850 (U.S.)

INTEGRATED PACKAGES

Name of package	Brief Description	Operating Requirements	Source and Price
INCREDIBLE JACK	An integrated package which contains programs for database management, spreadsheets, and word processing. The package can perform all three functions simultaneously, all visible on the screen, and driven by the same menu and commands. The data management system also has some spreadsheet capabilities. The database management system operates under a user defined screen format. The program can be used to generate form letters, invoices, etc. The word processing system in this package includes features such as automatic carriage return, error correction and block movement. Page lengths, margins, justification and spelling can all be altered.	Apple DOS 3.3, 64K, 2 disk drives	Business Solutions Inc. 60 Main Street Kings Park, New York 11754 U.S.A.; $179 (U.S.)
LOTUS 1-2-3	This package includes a data base manager, spreadsheet and graphics. The package has extensive spreadsheet capabilities. Graphics capabilities include bar graphs, pie graphs, line graphs and scatter and x-y charts. The package includes disk-based tutorials, and an extensive manual. Word processing communications and expanded record-keeping functions were added in the spring of 1984. The database manager of this integrated package can hold up to 256 fields per record in 2048 records. Master lists and mailing labels may be produced from data files. The spreadsheet can handle 256 columns and 2048 rows. Statistical formulae are included in this integrated package, as are logical comparisons.	MS-DOS 2 disk drives printer and plotter colour graphics adapter 128K	Lotus Development Corp. 161 First Street Cambridge, Massachusetts 02142 U.S.A.; $495 (U.S.)
MAPPER	A completely integrated software development language, available only for Sperry mainframe computers. It is easy to use (having been developed by non-data processing professionals) and very powerful. It can perform a range of operations from pocket calculator-level manipulations up to colour graphics production. Programmers can write their own applications programs to run on MAPPER. Seminars on MAPPER are given each month by Sperry. A catalogue of applications written for MAPPER is under development. MAPPER is available for the entire range of Sperry 1100 series hardware.	Sperry mainframe, memory requirement N/A	Sperry Univac Computer Systems 55 City Centre Drive Mississauga, Ontario (416) 270-3030; price N/A

INTEGRATED PACKAGES

Name of package	Brief Description	Operating Requirements	Source and Price
MAPPER **(con't)**	Capabilities include: • database management • electronic mail • graphics		
MBA	Context MBA's functions include: • database management • spreadsheet • graphics • word processing • communications MBA performs these functions in an integrated package (i.e. data from one program may be used in any other without adjustment). Data files can fill up to 16M (bytes or characters) of space with up to 95 fields per record. Up to six files may be sorted simultaneously. The graphics include bar graphs, pie charts, scatter plots, and line graphs, created from spreadsheet or data file information. MBA performs a variety of spreadsheet functions. The screen can be split into four windows for file manipulation. It performs word processing functions which include features such as word wrap, block or column moving or copying and printing that merges text and graphics.	PC-DOS colour graphics adapter 2 disk drives printer 256K	Context Management Systems 2386 Hawthorne Blvd. Suite 101 Torrance, California 90505 U.S.A.; $695 (U.S.)
PEACHTEXT 5000	This package has the following functions: word processing, mail list management, and spreadsheet. The package includes the standard word processing features, such as insertions, deletions, block moves, etc., but also includes mail-merge capability, a thesaurus and a spelling checker. Text can easily be moved from file-to-file. The spreadsheet module contains the standard spreadsheet features, and can produce a worksheet of 254 rows by 63 columns. Standard spreadsheet functions are included. The list manager module can create records with up to 14 line items, and sort them according to user-set criteria. It also controls mailing lists and labels. The package includes standard word processing functions: quick insertions, deletion, block moves and saves and file merging. Information can be transferred between files; two documents can be edited simultaneously and combined for printing.	MS-DOS 2 disk drives 128K	Peachtree Software Inc. 3445 Peachtree Road Northeast Atlanta, Georgia 30326 U.S.A.; $395 (U.S.)

INTEGRATED PACKAGES

Name of package	Brief Description	Operating Requirements	Source and Price
PEACH CALC	For details contact the City of Peterborough.		
STATGRAF	STATGRAF is an integrated package of data input, analysis and interactive graphics. Features include the following: -Data input/edit module with interactive graphic screen aids; -Analysis of variance for one, two or three independent variables with up to 15 levels, 500 subjects each; -Correlation analysis for up to 19 variables with as many as 500 subjects and adjustments for missing entries; -Graphics - bar graphs, scatter plots and data distribution map.	PC-DOS colour graphics adapter supports graphic plotter 64K	Village Information Co. Inc. 55 Christopher Street New York, New York 10014; $285 (U.S.)
SYMPHONY	More advanced version of LOTUS 1-2-3.	640K RAM DOS 2.0	Same as LOTUS 1-2-3. $500 (U.S.)
TK! SOLVER	An equation-solving program for engineering and business. An equation is entered, known values are typed in, and the program finds the unknown value. This can be used for statistical analysis. There are a number of present functions, such as sine, cosine, and net present value.	PC/DOS or MS-DOS IBM-PC/compatible 96K	Software Arts 27 Mica Lane Wellesley, Massachusetts 02181 U.S.A.; $299 (U.S.)
VISI ON	An almost totally integrated applications system. The separate modulates can be used to analyze and edit data, produce graphics from the data, and create reports. Operation is simplified by inclusion of a mouse, which can transfer blocks of text and data, among other functions. The integrated nature of the system allows easy transfer of information between modules. Files are completely compatible between modules. Includes a database management system which allows easy retrieval of specific information, manipulation of data and creation of mailing lists. The program requires a hard disk. The program contains an excellent graphics package. A variety of charts and graphics may be produced. Provides thorough word processing capabilities as part of an integrated software package.	PC-DOS hard disk 256K	Visi Corp 2895 Zanker Road San Jose, California 95134; $1710 (U.S.)

LAND USE PLANNING

Name of package	Brief Description	Operating Requirements	Source and Price
DWELLMOD	This program suite is a resource and cost evaluation methodology for individual dwellings and housing projects. The suite consists of the following six programs, which may be used independently or sequentially: Dwelldem calculates numbers and totals of dwellings and their areas; Elem expands on the nature of the dwelling units, to quantify individual elements such as walls, roofs and windows; Beep has two functions (i) to calculate material and labour quantities and costs for building elements and subelements and in total (ii) to calculate coefficients which define labour and material resource inputs per unit of element and building for use in the Resormat and Resorlab programs; Consbeep is used with the Beep program to combine a number of materials or labour trades into a single class; the Resormat and Resorlab programs function identically, to evaluate labour and material resources.	CP/M, C-Basic, 64K, 1 disk drive, 130 character wide printer	CSIRO Division of Building Research P.O. Box 56 Highett, Victoria, 3190 Australia; price N/A
LOWRY MODEL PROGRAM	This model tries to simulate the process by which activities are generated and located in the spatial economy. The inputs required for the model are basic employment, maximum activity constraints, population, service employment, and distances. To use the model to predict activity, the program must be run with the inputs listed above, and then run again using the outputs from the first run, new basic employment and new attractor variable values.	mainframe, memory requirement N/A	A. Rodriquez-Bachiller Department of Town Planning Oxford Polytechnic Oxford, U.K.; price N/A
LUEP	LUEP is intended to aid in the production and evaluation of land use plans, by comparing housing, industrial and road development schemes. The program operates by producing a number of indicators of performance, measured in cost and benefit terms. In the program, the study area is divided into a number of homogenous zones, linked by transport networks. Costs include those of construction and demolition, sewerage costs, and transport costs. Benefits include agricultural value, benefits of housing and benefits of service industries.	mainframe, memory requirement N/A	Local Government O.R. Unit Royal Institute of Public Administration 201 Kings Road Reading RG1 4LH U.K.; price N/A

LAND USE PLANNING

Name of package	Brief Description	Operating Requirements	Source and Price
THE OPPORTUNITY MODEL	The Opportunity Model is a planning analysis technique which provides information to assist decisions relating to: -strategic land use, network and energy planning -specific site locations for facilities or services -definition of appropriate catchment areas for service or facility coverage. The model can evaluate the accessibility implications of alternative land use distributions - whether a single site or an entire land use plan. The method can take account of 'overlapping' services or market catchment areas, to indicate: the relative performance of alternative strategies over a whole study area; • the incidence of benefits and disbenefits, for each alternative, throughout each part of the study area. The Opportunity Model requires input data describing: • distances (or times) between all pairs of zones in the study area; • data for each zone describing the land uses which are being studied.	CP/M, 64K	M.M. Dillon Limited 47 Sheppard Avenue East Toronto, Ontario M2N 6H5; price N/A
PERP	This program involves the comparison of various strategies for development plans, performed with the aid of plan evaluation matrices, which illustrate numerically how well objectives are met under alternative plans. The use of a computer to compare strategies permits the evaluation of a large number of alternatives. The program also permits the inclusion of factors of uncertainty in the choice of strategy. The program can be used to calculate the scores and weights used in measuring the performance of the strategies, and also to test the robustness of each strategy to possible future changes.	mainframe, memory requirement N/A	Local Government O.R. Unit Royal Institute of Public Administration 201 Kings Road Reading RG1 4LH U.K.; price N/A
PREPHAS	This program is intended as a tool for selecting optimal areas for growth in employment and population, and for phasing their development over the life of a plan. The program aids in choosing the best time and place for each new development to match the total growth in housing, industry and commerce in a given area, while meeting the criterion of the plan's objectives. Costs and benefits are predicted for a	mainframe, memory requirement N/A	Local Government O.R. Unit Royal Institute of Public Administration 201 Kings Road Reading RG1 4LH U.K.; price N/A

LAND USE PLANNING

Name of package	Brief Description	Operating Requirements	Source and Price
PREHAS **(con't)**	set of weighted objectives, and these are combined to produce an overall measure of the value of developing each zone at any time in the plan's life. There is provision made for imposing constraints on the development, and for determining the best overall phasing.		
RESIDENTIAL LAND REQUIREMENTS	The Residential Land Requirements model determines residential land requirements for a certain time period, based on assumptions regarding population growth, average household size, housing density, vacant housing stock, residential yield and oversupply.	mainframe/adaptation to micro possible, memory requirement N/A	M.M. Dillon Limited 47 Sheppard Avenue East Toronto, Ontario M2N 6H5; price N/A

MAILING LISTS

Name of package	Brief Description	Operating Requirements	Source and Price
FIRST CLASS MAIL	This mailing list manager allows creation of custom applications with a menu-driven format. Mailing lists and labels can be created. Up to 25,000 records can be stored, and fields can contain up to 132 characters. The program requires at least one disk drive.	PC-DOS, 128K	Continental Software 11223 South Hindry Avenue Los Angeles, California 90045 U.S.A.; $125 (U.S.)
MAIL MERGE	For details contact the Town of Caledon.		
MAILING LIST	The Mailing List program is capable of sorting 650 addresses per disk. Mailing lists, labels and envelopes can be printed. Sorting can be by first or last name, state or zip code.	PC-DOS, 64K	N.L. Nehring Box 61152 Sunnyvale, California 94096 U.S.A.; $75 (U.S.)
MAILING LIST PROGRAM	This program sets up and maintains a mailing list. It automatically alphabetizes the list. Up to 12 fields, 30 characters per field are allowed. There are sorting and searching capabilities.	PC-DOS, 64K	Software Laboratories, Inc. 6924 Riverside Drive Dublin, Ohio 43017 U.S.A.; $50 (U.S.)
PC-FILE	PC-File is a user-supported program that, aside from managing lists, also performs mathematical calculations, and Boolean logic. Files can hold up to 32,000 records, but only 4,000 may be sorted at once. The program is menu driven. The program requires at least one disk drive.	PC-DOS, 64K	Jim Button Box 5786 Bellevue, Washington 98006 U.S.A.; $35 (U.S.)

MAILING LISTS

Name of package	Brief Description	Operating Requirements	Source and Price
TIME MANAGER	The program is a system for organizing one's time, while maintaining records for future reference. Events related to specific, user-designated categories may be called up.	PC-DOS, 64K	IBM Box 1328 Boca Raton, Florida 33432 U.S.A.; $122 (U.S.)
TOTAL RECALL: THE LIST MANAGER	The program manipulates lists of up to 32,000 records. Three levels of sorting may be performed for record selection, as well as exact, partial and range matches. Totaling of numeric fields is possible. A label generator is also included. Records are limited to 15 fields, each field holding up to 35 characters.	PC-DOS, 128K	The Softa Group 778 Frontage Road Northfield, Illinois 60093 U.S.A.; $130 (U.S.)
WATFILE	WATFILE is a list management program that can sort lists, print labels, and do rudimentary calculations and report writing.	PC-DOS, 64K	Department of Computing Services University of Waterloo Waterloo, Ontario N2L 3G1

MAPPING

Name of package	Brief Description	Operating Requirements	Source and Price
MAPSCAN	MapScan consists of data preparation and mapping utilities to group areas by data classes, and produce maps which display the classes. Map scales may be user-defined. Input data includes the cartographic database and a data file which may contain geographic codes, census data and user data. Maps include a legend, title, footer and other user-input text, and may be produced at a number of levels. Maps may be fitted to any pre-printed base map showing major geographical features. Maps can be produced in colours.	Apple II: UCSD p-system, 64K PC-DOS, 128K	Keith Satter Claritas Corporation 1911 N. Fort Myer Drive Arlington, Virginia 2209 U.S.A.; price N/A
MICROMAP II	The package consists of 18 programs. The thematic mapping programs produce shaded area maps, or maps with proportional circles or polyhedrons, used to represent statistics. The contour map programs produce three kinds of contour: splined contours, terrain models, and Thiessen polygons, which place a geographic point of interest at the centre of each polygon. The graphing program offers standard graphs. Six types of maps and four kinds of graphs can be produced.	Apple DOS adaptation to MS-DOS underway 64K	E. Matthews Morgan-Fairfield Graphics Box 85457 Seattle, Washington 98105 U.S.A.; Complete package - $650 (U.S.), programs also sold separately.

MAPPING

Name of package	Brief Description	Operating Requirements	Source and Price
MULTIMAP I	A package of three programs. One program would use digitized maps or data files to create appropriate boundaries. The second would group census data by neighbourhood, and the third calls up data from the first two to create a thematic map. Maps can be in shades of grey, or in colours. Producer prefers to sell package with hardware, including TeleVideo microcomputer with 64K memory, database management, word processing and spreadsheet software, printer and plotter - cost about $10,000 (U.S.). Multimap I can be obtained separately.	see 'Description', 64K	B.R. Cohen Planning Data Systems 1601 Walnut Street, #1524 Philadelphia, Pennsylvania U.S.A. 19103; for price see 'Description'.

MISCELLANEOUS

Name of package	Brief Description	Operating Requirements	Source and Price
ACC	This is an accessibility analysis program, in which land use/transport network data is analyzed. Census and employment data are used for catchment/opportunities analysis. The program is written in FORTRAN, and operating instructions are included.	24/32-bit machine mainframe, memory requirement N/A	County Surveyors Department Mid Glamorgan County Council Greyfriars Road Cardiff, Wales CF1 3LJ U.K.; price N/A
COHORT SURVIVAL MODEL	This program is a population projection model based on 5-year age groups. It considers natural increase and migration in the projection, and calculates the number of dwelling units based on headship rates for age groups. The program is an adaptation of a program devised by the Region of Peel, and it is written in BASIC.	MS-DOS, 64K	Robert Lehmann Planning Consultants Limited 105 Collier Street Barrie, Ontario L4M 1H2 (705) 737-4512; price negotiable
ELECTRE	The program is a multi-criteria decision-aid model, which allows analysis of several criteria at once, and subjective evaluation. The algorithm is based on the conditions of concordance (i.e. a majority of criteria favour action A) and discordance (i.e. no criterion favours B). Paired comparisons are made to evaluate options, and hence to determine a course of action.	Apple DOS, 48K	'Executive Planning with BASIC' by X.T. Bui published in book form by Sybex Inc., 1983; price N/A
EXTRA	EXTRA calculates modal split, operating ratios, emissions and other impacts associated with a planned express bus route. A single destination for the route is assumed, with impedances for auto and transit being input manually.	PC-DOS, 64K	William G. Barker and Associates 1009 W. Randol Mill Road Arlington, Texas 76012 U.S.A.; price N/A

MISCELLANEOUS

Name of package	Brief Description	Operating Requirements	Source and Price
HEISE	This program may be used for the collection and analysis of attitudinal survey data on a microcomputer. It can also be set up for demonstration or teaching purposes.	8-bit, 64K	CSIRO Division of Building Research P.O. Box 56 Highett, Victoria, 3190 Australia; price N/A
INET ROUTE CARD EDITOR	This program allows for the input and editing of route cards for the UTPS program INET. It thus saves on mainframe computing costs and time. Virtually all of INET's features are included. Route card data are validated against a network created by HNET.	Apple Pascal Apple II 64K	MTP Support Centre Transportation Systems Centre Kendall Square Cambridge, Massachusetts 02142 U.S.A.; price N/A
OPTISITE	A general purpose site location model, consisting of several interacting programs. The user can locate one or more warehouses, distribution centres, or other facilities and assign customers, sales outlets or other demand/supply points to each site. OPTISITE's basic analytic functions include the following: Demand/Supply Point Assignment - determines an optional assignment of demand points (e.g. customers) and/or supply points (e.g. warehouses). Site Location - also determines the optimum location(s) of one or more sites and estimates transportation costs. 'What-If' Analysis' - allows one or more sites to be fixed at chosen locations and demand/supply point assignments changed to answer 'what-if' questions. The program utilizes grid-reference coordinates for physical locations.	The program will run on: Apple II, IIe and III IBM-PC (and 'compatibles'); memory requirement N/A	MicroAnalytics Inc. 8409 Hunt Valley Drive Vienna, Virginia 22180 U.S.A.; $495 (U.S.)
PLANAPS	Processes town planning applications and building applications from initial receipt of the application to the final decision on the project. Details of individual applications can be retrieved for display on a VDU, and printed documents include application and management reports. The program is written in COBOL/SCL, and includes upgrading.	mainframe; memory requirement N/A	ICL 5 South Parade Leeds, Yorkshire U.K. LS1 5QZ; price N/A
POPPROJ	This program allows the user to establish a single region, Cohort survival population projection model.	8-bit, 64K	CSIRO Division of Building Research P.O. Box 56 Highett, Victoria, 3190 Australia; price N/A

MISCELLANEOUS

Name of package	Brief Description	Operating Requirements	Source and Price
POPULATION PROJECTIONS	For details contact the Regional Municipality of Ottawa-Carleton.		
PROJECTIONS 5	For details contact the County of Essex.		
TOPLAY	This program is a mathematical planning model designed to optimize the spatial layout of building systems, in two or three dimensions (e.g. single or multi-storey buildings).	An 8-bit microcomputer using the CP/M operating system or 16-bit micro using MS-DOS. A printer, BASIC-80 compiler, F80 FORTRAN compiler and a text editor are desirable.CSIRO	Division of Building Research P.O. Box 56 Highett, Victoria, 3190 Australia; price N/A
UMTA FILE EDITOR	This is a Pascal unit which can be used to add interactive data file editing capabilities to a user-written program. It allows horizontal and vertical scrolling, record editing, automatic range checking and a variety of data types.	Apple Pascal two disk drives 64K	MTP Support Center Transportation Systems Centre Kendall Square Cambridge, Massachusetts 20818 U.S.A.; price - NIL
UMTA SCREEN EDITOR	This is an interface program which facilitates the processing of interactive input from a keyboard - CRT into an applications program. This is done through the creation of templates on the CRT.	Apple Pascal: Apple II USCD p-system: IBM-PC two disk drives 64K	MTP Support Centre Transportation Systems Centre Kendall Square Cambridge, Massachusetts 02142 U.S.A.; price - NIL
URBEMIS #1	The program estimates emissions resulting from land use projects such as shopping centres, condominium developments and subdivisions. It allows comparison of emissions as a function of type of land use, the number and type of vehicle trips, and the total vehicle miles of travel produced.	Apple DOS, 48K	Administrative Services Division California Air Resources Board P.O. Box 2815 Sacramento, California 95812 U.S.A.; $13 (U.S.)

PROJECT MANAGEMENT

Name of package	Brief Description	Operating Requirements	Source and Price
PROJECT SCHEDULER	This is a project management program intended to help management meet deadlines and beat cost targets through project forecasting, scheduling, control and tracking of project status. The program creates a GANTT chart and calculates the critical path.	PC-DOS, 128K	Scitor Corporation Suite 201 710 Lakeway Sunnyvale, California 94086 U.S.A.; $285 (U.S.)
VISI SCHEDULE	Visi Schedule is an aid to project planning. Project information, such as start date and manpower skill needs, is typed into the computer and a graphic representation of the required schedule is created. As many as 160 activi-	Apple DOS 3.3, 48K	Visi Corp 2895 Zanker Road San Jose, California 96134 U.S.A.; $300 (U.S.)

PROJECT MANAGEMENT

Name of package	Brief Description	Operating Requirements	Source and Price
VISI SCHEDULE **(con't)**	ties may be included. Labour costs may be calculated. The program requires two disk drives.		

RETAIL MODELLING

Name of package	Brief Description	Operating Requirements	Source and Price
CULLEN RETAIL MODEL	Models systems of retail centres. The program is based on a gravity model, formulated through the process of statistical mechanisms. Inputs to the program include observed average shopping trip length, average travel speed, costs of travel, and number of consumers or households in each zone, as well as retail centre information. The program allows for a wide range of analyses. Outputs include the sum of squares of the differences between actual and calculated sales for each centre, average trip length and the number of consumers or households shopping at each centre.	mainframe, memory requirement N/A	Professor R.W. McCabe 40 Sylvan Valleyway Toronto, Ontario M5M 4M3 (416) 783-1665; price N/A
HUFF RETAIL MODEL	Models systems of retail centres. The model is based on the assumptions that the areas of competition overlap and that hence shopping activities are apportioned to accessible centres in a probabilistic manner. Inputs include the number of zones, total number of retail locations, and data on each retail centre. A wide variety of analysis options are available, which allows testing of the implications of a number of situations. Output includes the profit fraction for a given size of retail operation, the number of consumers going to each retail centre, and average income available for retail spending in a given zone.	mainframe, memory requirement N/A	Professor R.W. McCabe 40 Sylvan Valleyway Toronto, Ontario M5M 4M3 (416) 783-1665; price N/A
RETAIL IMPACT MODEL	For details contact the City of Sault Ste. Marie.		
SCOPE	The SCOPE system consists of an operational database, an executive control system, and three major forecasting models: • the Regional Economic Model • the Sector Model (including a land use submodel) • the Retail Models (including Regional, Sector and Neighbourhood submodels).	IBM mainframe, memory requirement N/A	Decision Sciences Corporation Benjamin Fox Pavilion Foxcroft Square Jenkintown, Pennsylvania 19046 U.S.A.; price N/A

RETAIL MODELLING

Name of package	Brief Description	Operating Requirements	Source and Price
SCOPE **(con't)**	The system can assess: • the ability of a city to meet consumer needs; • the impact of suburban commercial complexes on central area retail facilities; • the need for additional retail and commercial facilities; • the impact of additional facilities; • effects of variations in population densities. The system was produced for the City of Ottawa.		
STEWART'S HIERARCHICAL RETAIL MODEL	Simulates the pattern of retail demand and impact for hierarchical systems of retail centres. Required inputs include data on shopping centres, consumers or households per zone and costs of travel. A range of analytical options are included, in order to allow simulation of a variety of scenarios. Outputs include a measure of profit for retail operations, consumer trips to retail centres, and sales at each centre.	mainframe, memory requirements N/A	Professor R.W. McCabe 40 Sylvan Valleyway Toronto, Ontario M5M 4M3 (416) 783-1665; price available from source

SPREADSHEETS

Name of package	Brief Description	Operating Requirements	Source and Price
DESKTOP PLAN	Allows users to create financial models using a modelling language, rather than directly on a spreadsheet. Menu-driven, the program requires input on model size, calculation rules, starting values and user-defined formulae. The program prints formatted reports, tables, charts and graphs. The program requires two disk drives.	PC-DOS/Apple SOS, 64K	Visi Corp. 2985 Zanker Road San Jose, California 95134 U.S.A.; $300 (U.S.)
MAGICALC	For details contact the Regional Municipality of Peel.		
MULTIPLAN	Multiplan's spreadsheet has 63 columns and 255 rows. It allows the creation of up to eight windows (in colour). Cells may be named, and the names used in formulas. Information can be changed on a number of sheets simultaneously. Report formatting is available, and there is a routine by which Multiplan data may be transferred to other programs. A tutorial disk, comprehensive manual and reference card are included.	MS-DOS/CP/M/Apple DOS 3.3 or SOS, 64K	Microsoft Corp. 10700 Northup Way Bellevue, Washington 98004 U.S.A.; $375 (U.S.)
NYPLAN	For details contact the Regional Municipality of Peel.		

SPREADSHEETS

Name of package	Brief Description	Operating Requirements	Source and Price
SUPERCALC 2	SuperCalc 2 is the advanced version of SuperCalc. The spreadsheet has 63 columns and 254 rows, and an extensive array of attributes assignable to cells. There are eight user-definable keys available. Unique functions include the ability to consolidate similar files into larger models, the use of partial spreadsheets and single-key abilities. Report formatting is available, as is a conversion function for moving information between programs. A tutorial disk is supplied with the program, and there is a 'Help' facility included in the program.	PC-DOS/Apple DOS 3.3/CP/M, 128K	Sorcim 405 Aldo Avenue Santa Clara, California 95050 U.S.A.; $295 (U.S.)
SUPERCALC 3	For details contact the Regional Municipality of Ottawa-Carleton.		
VISICALC	For details contact the Town of Caledon.		Visicorp, U.S.A.
VISICALC: ADVANCED VERSION	This program is the successor to the immensely popular Visi Calc, a financial spreadsheet program featuring fiscal analysis, and allowing windowing. Each cell can be assigned up to 37 attributes. Calendar functions, such as conversion between real and absolute dates, are included. Keystroke memory is another valuable function: a series of keystrokes (1-125) can be assigned a name, which can then be used as a command. Extensive report formatting features are also included. Visi Calc files can be also read into any word processing or communications program employed on the operating system, or transferred between spreadsheets. Documentation includes a tutorial, reference guides, and command chart. This spreadsheet program has the capability to perform some statistical analyses, aided by added math functions found in the Advanced Version. The program requires two disk drives.	Apple SOS Apple III 128K	VisiCorp 2995 Zanker Road San Jose, California 95134 U.S.A.; $400 (U.S.)

STATISTICS

Name of package	Brief Description	Operating Requirements	Source and Price
ABSTAT	A package for entering, editing, transforming and statistically analyzing data.	CP/M, 64K MS-DOS, 128K	

STATISTICS

Name of package	Brief Description	Operating Requirements	Source and Price
ABSTAT **(con't)**	The programs run interactively and can produce reports and graphs on the screen or on a printer. Capabilities include: • Descriptive Statistics, mean, standard deviation, variance, standard error or mean, coefficient of variation, median mode, minimum, maximum, range, skewness and kurtosis. •Frequency Distributions - listing of the values, frequencies, percents and Z-scores. •Statistical Routines - t-test, chi-square, analysis of variance, correlation, simple and multiple linear regression. •Cross Tabulation - for discrete or automatically scaled variables. •Graphing Abilities - bar graphs and scatter plots. The available memory determines the number of cases and the number of variables (max. 20 for CP/M and 64 for MS-DOS). Output can be directed either to the screen or to the printer.		Anderson-Bell 425 Main Street Suite 10 P.O. Box 191 Canon City, Colorado 81212 U.S.A.; $395 (U.S.)
MICRO DATA ANALYZER (MDA)	An interactive statistical analysis package with the following capabilities: •Statistical summaries - mean, variance, minimum, maximum, sum standard deviation, coefficient of variation. •Histograms - display the distribution of variable values as bar charts. •Plots - scatter diagrams of variable values, for two axes, along with descriptive statistics and regression values. •Crosstabulation Tables - two-way and multi-way tables with chi-squared statistics. •Breakdowns - statistical summaries for one or several variables. •Correlation and Covariance Analysis. •Least Squares Regression - includes simple and multiple regression with and without intercept terms and saving of residuals. •Multinomial Logit Analysis - enabling binary or multiple choice analysis. Some key operational features of MDA are: • new variables can be created or existing variables modified using transformations • all analysis modules have capabilities for handling missing data	MS-DOS CP/M TRS-DOS, 64K	Cambridge Information International 238 Main Street Suite 310 Cambridge, Massachusetts 02142 U.S.A.; $349 (U.S.)

STATISTICS

Name of package	Brief Description	Operating Requirements	Source and Price
MICRO DATA ANALYZER (MDA) **(con't)**	• analysis results and data file summaries can be directed to a printer, displayed at the terminal or both • data sets are stored on disk, so that the size of the data to be analyzed is limited only by the computer's storage capabilities.		
MICROSTAT	A data analysis and statistics package, having major capabilities as follows: • A Data Management Subsystem - for file creation, editing, listing, sorting, merging and transferring data. • Descriptive Statistics - mean, sample standard deviation, variance, minimum, maximum, sum, sum of squares, moments about the mean, skewness, kurtosis, deviation sum of squares. • Statistical Tests - hypothesis tests, analysis of variance, nonparametric tests. • Scatterplots Regression Analysis - simple, multiple and stepwise Time Series Analysis Cross tabulations Fractionals, Permutations, Combinations and Probability Distributions A particular feature is the choice of algorithms selected specifically to reduce errors introduced by the use of large numbers frequently used in statistical calculations.	CP/M PC-DOS, memory requirements N/A	Ecosoft Inc. P.O. Box 68602 Indianapolis, Indiana U.S.A. (462) 468-0602; $325 (U.S.)
SAS	A comprehensive statistics package that can perform regression analysis, sorting, analysis of variance, report formatting, plotting, etc. The package is versatile and easy to use, and extensive documentation is provided in the form of an Introductory Guide, Users Guide, Programming Guide and so on. The package can be purchased for a mainframe, or may also be available from a local university or other institution on a charge-for-use basis. A number of modules are available (for varying costs), and can provide much greater capabilities, including time series, forecasting, linear programming, econometrics, etc.	mainframe (adaptation to micros is underway), memory requirements N/A	SAS Institute Box 8000 Cary, North Carolina 27511 U.S.A.; Level One (basic package) $4500 (U.S.), prices for other modules available from source
SPSS	A comprehensive statistics package, intended for use in the social sciences. It includes features such as regression analysis, analysis of variance, and plotting. The package may be purchased for a mainframe, or if a local university or other institution has	mainframe (micro package listed as 'STATPAC'), memory requirements N/A	SPSS Suite 3000 444 N. Michigan Avenue Chicago, Illinois 60611 U.S.A.; price available from source

STATISTICS

Name of package	Brief Description	Operating Requirements	Source and Price
SPSS **(con't)**	SPSS on its computing system, it may be possible to employ it on a charge-for-use basis. There is extensive documentation available on SPSS.		
STATISTICAL ANALYSIS I	This menu-driven program performs linear regression analysis, determines the mean, standard deviation and plots the frequency distribution of user supplied data sets.	Apple DOS, 48K PC-DOS, 64K	Spectrum Software 690 W. Freemont Avenue Sunnyvale, California 94087 U.S.A.; $50 (U.S.)
STATISTICAL PACKAGE	For details contact the Regional Municipality of Halton.		
STATPAC	A menu-driven statistical analysis package modelled on the SPSS mainframe program. Capabilities of STATPAC include: • Data Management - entering new data, editing existing data, printing a data file. • Data Tabulation - write a subfile, univariate frequency distribution, descriptive statistics (maximum, minimum, range, sum, mean, median, mode, variance, standard deviation, standard error of mean, skewness, kurtosis), crosstabs. • Statistical routines - chi-square, correlation, linear regression, t-test, multiple regression with up to 30 variables, analysis of variance. • Utility programs - sort cases enables datafile to be sorted by any variable in ascending or descending order; list cases allows reports to be custom designed from a date file. • Graphics - scattergrams produced, including the best-fit regression line. STATPAC is limited to 255 variables and 5000 cases.	MS-DOS, 128K RAM	Walonick Associates 5624 Girard Avenue S. Minneapolis, Minnesota 55419 U.S.A.; $400 (U.S.)
THE SURVEY SYSTEM	An integrated system of programs for the entry, editing, processing, and presentation of survey research results. The main features include: • cross tabulations, scored variable tables, and camera ready bar charts; • editing and manipulative capabilities which include weighting questionnaires, selecting subsamples, and creating new variables; • basic statistics which include chi-square, means and standard deviations; • tables can be viewed on the screen, printed or written to disk.	MS-DOS, 128K RAM	Creative Research Systems 1864 Larkin Street San Francisco, California U.S.A. 94109; $495 (U.S.)

STATISTICS

Name of package	Brief Description	Operating Requirements	Source and Price
THE SURVEY SYSTEM **(con't)**	Two optional expansion programs include: • the ability to use an optical card reader as an alternative data entry system; • a module intended for use with coded responses to open ended questions. Emphasis in the package is placed on ease of use and 'professional' tabulation layout. Questionnaires may be up to 1000 columns long.		
SCSS	For details contact the City of Thunder Bay.		
THEIL'S U STATISTIC	The program provides a measure of forecast inequality (U or U2) stated as a coefficient which permits decomposition into systematic errors of prediction, errors due to standard errors of predicted and actual values, and error due to lack of positive covariance.	mainframe, memory requirement N/A	Professor R.W. McCabe 40 Sylvan Valleyway Toronto, Ontario M5M 4M3 (416) 783-1665; price available from source

TRANSPORTATION MODELLING

Name of package	Brief Description	Operating Requirements	Source and Price
ASSIGN	Performs traffic generation, distribution and assignment. The assignment is performed using a minimum time path algorithm, and traffic is distributed using a gravity model. Either an all-or-nothing or incremental assignment is possible. A system of 150 zones and 1500 links can be accommodated.	Apple II Plus, 48K	W. Kittleson CH2M Hill 2020 SW 4th Avenue 2nd Floor Portland, Oregon 92701 U.S.A.; price N/A
DODOTRANS II	This is a software system by which managers, engineers and planners can conduct analyses using models and other procedures appropriate to their own area of interest. It provides a library environment containing data files, database management capabilities, and application modules. Models may be strung together in any desired way to do analyses. The program requires two disk drives.	Apple Pascal, 64K	MTP Support Centre Transportation Systems Centre Kendall Square Cambridge, Massachusetts 02142 U.S.A.; price - NIL

TRANSPORTATION MODELLING

<table>
<tr><th>Name of package</th><th>Brief Description</th><th>Operating Requirements</th><th>Source and Price</th></tr>
<tr><td>ICL</td><td>The program distributes traffic over a road system between defined zones of origin and destination, according to capacity restraint principles. The consequences of changing either the road network or traffic can be assessed. The program identifies the shortest route through the network in terms of time, and also gives average speed, trip length and time, and total network mileage. The program is written in FORTRAN.</td><td>mainframe, memory requirement N/A</td><td>David Abraham & Partners
71 Kealey Road
London SW19 3JJ
U.K.; price N/A</td></tr>
<tr><td>MICROTRIPS</td><td>MICROTRIPS is a comprehensive package paralleling UTPS in functional capability for systems up to 150 zones, 2000 links. Interactive demand estimation and network assignment for highway and transit systems plus generalized matrix manipulation and summarization.
Specific features include:
• capacity restraint with either incremental, iterative or volume averaging methods;
• distribution or modal choice models can use either mathematical or empirical curves.</td><td>CP/M, 64K</td><td>PRC Voorhees
1500 Planning Research Drive
McLean, Virginia
22102
U.S.A.; $12,500 (U.S.)</td></tr>
<tr><td>MINUTP</td><td>A transportation planning system, similar in operation to UTPS, PLANPAC, TRANPLAN, etc., but dealing only with the highway mode.
Modules are available for
• network and path building
• trip generation and distribution
• matrix manipulation and conversion
• traffic assignment
• report generation.
Specific features include:
-traffic assignment including capacity restraint on an iterative or incremental basis;
-programs can be run in 'batch' mode or in 'console' mode with optional help screens; a complete run can be set up to proceed through all programs, or the user can interrupt and restart the process wherever desired.
The capacity of MINUTP varies with system configuration between the following minimum and maximum:
<table>
<tr><th>System</th><th>Zones</th><th>Nodes</th><th>Links</th></tr>
<tr><td>PC-DOS, 128K RAM 2x320 disks</td><td>100</td><td>300</td><td>500</td></tr>
<tr><td>PC-DOS, 320K RAM 5 meg. disk</td><td>1000</td><td>4000</td><td>16000</td></tr>
</table></td><td>CP/M: 64K RAM;
2 x 320K disks
PC-DOS: 128K RAM;
2 x 320L disks up to 320K RAM; 5 meg. disk</td><td>Comsis Corporation
The 1200 Building
2685 Marine Way
Mountain View, California
U.S.A. 94043;
IBM-PC version $5000 (U.S.)</td></tr>
</table>

TRANSPORTATION MODELLING

<table>
<tr><th>Name of package</th><th>Brief Description</th><th>Operating Requirements</th><th>Source and Price</th></tr>
<tr><td>MOTORS</td><td>An integrated package of 30 modules designed to cover the whole range of multi-modal transportation planning functions.
The programs are based on the sequential travel demand modelling process, with choices of technique available at each stage.
The capacity of MOTORS varies with system configuration, between the following minimum and maximum:
<table>
<tr><th>System</th><th>Zones</th><th>Nodes</th><th>Links</th></tr>
<tr><td>CP/M, 64K RAM 2x320 disks</td><td>200</td><td>800</td><td>2500</td></tr>
<tr><td>MS-DOS, 256K RAM 10 meg. disk</td><td>400</td><td>2000</td><td>6000</td></tr>
</table></td><td></td><td>M.M. Dillon Limited
47 Sheppard Avenue East
Toronto, Ontario
M2N 6H5; $6000 highway and transit, $4000 only highway or only transit</td></tr>
<tr><td>MTPS</td><td>The package consists of eight programs that predict traffic assignments. These programs are:
NETWORK: defines the highway network
SHORTPATH: finds the shortest path between zones
TRIPPUR: sets up purpose categories for trips
TRIPGEN: inputs trip productions and attractions for each zone
ASSIGN: uses a standard gravity model to develop a trip table
ADDER: combines trips to give total volumes
LINKVOL: prints out traffic volumes on links
TRIPTAB: prints the trip tables</td><td>Apple DOS/PC-DOS, 64K</td><td>C. Manning
Creighton Associates Inc.
274 Delaware Avenue
Delmar, New York 12054
U.S.A.; $500 (U.S.)</td></tr>
<tr><td>MULATM</td><td>This program model produces short duration traffic flows and travel conditions in a street network representing a small part of an urban area. It can be used for evaluating alternative traffic management schemes, studies of traffic generation such as shopping centres, studies of congestion, queueing and network performance, and for planning the location patterns of speed and access control devices in residential areas.</td><td>16-bit micro, MS-DOS, 64K</td><td>CSIRO
Division of Building Research
P.O. Box 56
Highett, Victoria, 3190
Australia;
price N/A</td></tr>
<tr><td>MULTISIM</td><td>This program provides a model of the effects of changes to the travel environment on vehicle behaviour, and enables the user to extract any information he desires from the system for subsequent analysis.</td><td>Will run on a wide variety of computers, from mainframes to micros.</td><td>CSIRO
Division of Building Research
P.O. Box 56
Highett, Victoria, 3190
Australia;
price N/A</td></tr>
</table>

TRANSPORTATION MODELLING

Name of package	Brief Description	Operating Requirements	Source and Price
TMODEL	A trip distribution and traffic assignment program. TMODEL uses a gravity model/ skim tree/ capacity restraint technique to analyze peak hour travel demands. In defining the gravity model for application each iteration, both link and intersection capacities and delays are used to calculate travel times. TMODEL uses many parameters and assumptions of NCHRP report 187 "Quick Response Urban Travel Estimation Techniques and Transferable Parameters", TRB 1978. 75 zones and 350 links can be modelled.	Apple II+, 64K	Professional Solutions Inc. 3765 N.W. 173rd Place Beaverton, Oregon 97006 U.S.A.; $1200 (U.S.)
TPS	For details contact Metro Toronto.		
TRANPLAN	This is a comprehensive transportation planning package. It can accommodate 3000 zones and 16000 links. TRANPLAN's suite of programs include: • trip distribution • modal split • networks • path building • matrix utilities • reporting • plotting	UNIX PC-DOS adaptation underway 256K required, 512K recommended	J. Fennessy DKS Associates 1419 Broadway, Suite 200 Oakland, California 94612 U.S.A.; price N/A
TRSTRANS	For details contact the Regional Municipality of Halton.		
UTPS	For details contact the Regional Municipality of Ottawa-Carleton.		

WORD PROCESSING

Name of package	Brief Description	Operating Requirements	Source and Price
APPLE WRITER IIe	This word processor includes features for right-justified text, movement by block, extensive cursor control, thorough insertion and deletion control and a variety of printing formats. The program in menu-driven, has windowing capability and can produce mailing lists.	SOS Apple IIe 48K	Apple Computer, Inc. 20525 Mariani Avenue Cupertino, California 95014 U.S.A.; $195 (U.S.)
APPLE WRITER 3	For details contact the City of Sault Ste. Marie.		
CORRECT STAR	For detailed contract the Regional Municipality of Durham.		
DATA STAR	For details contact the City of Brampton.		

WORD PROCESSING

Name of package	**Brief Description**	**Operating Requirements**	**Source and Price**
DICTIONARY	For details contact the Regional Municipality of Halton.		
EASY WRITER	For details contact the City of Toronto.		
EASY WRITER II	Easy Writer II is a powerful word processor, with good documentation. Text control can produce right justification, centering and movement by block. Cursor control can be by word, line, sentence, paragraph or beginning/end. There are good insertion capabilities. Correctability features include finding a word or phrase, and replacing it either a number of times or globally. A variety of print types are possible.	MS-DOS IBM-PC or TI Pro 64K	Information Unlimited 281 Arlington Avenue Kensington, California 94707 U.S.A.; $350 (U.S.)
GRAMMITIK	For details contact the Regional Municipality of Ottawa-Carleton.		
HONEYWELL WORD PROCESSING PACKAGE	For details contact the Town of Stoney Creek.		
KEYPAD EDITOR	For details contact the Regional Municipality of Peel.		
PEACHTREE	For details contact the City of Chatham.		
PERFECT WRITER	Perfect Writer uses a split-screen, multiple-file display, allowing merging and manipulation of text from up to seven files. Files of up to 200 pages are allowed. Table of contents generation is included, as are 50 preset formats and the capability to create formats.	CP/M or MS-DOS 1 disk drive 64K	Perfect Software 702 Harrison Street Berkeley, California 94710 U.S.A.; $495 (U.S.)
PROGRAMS FOR AES	For details contact the Town of Newcastle.		
SCRIPTSIT	For details contact the Regional Municipality of Halton.		
SPELLSTAR	For details contact the Regional Municipality of Ottawa-Carleton.		
STAR INDEX	For details contact the Regional Municipality of Durham.		

WORD PROCESSING

Name of package	Brief Description	Operating Requirements	Source and Price
VISIWORD	VisiWord is menu-driven, and has windowing ability. Printing can be in bold, with sub or superscripts and underlining. Correction features include finding a word or phrase and replacing it globally. Thorough insertion and deletion features are included. Cursor control is only by block, paragraph and beginning/end. Thorough documentation is included.	MS-DOS IBM-PC/XT 192K	Visi Corp 2895 Zanker Road San Jose, California 95134 U.S.A.; $375 (U.S.)
VOLKSWRITER	Volkswriter's features include search of a text beginning at any point, multiple headers and footers, full cursor control and multiple formats. Automatic backup during save/copy operations, deleting and merging features are also featured. The International Edition has, in addition to Volkswriter's capabilities, the power to create math, science and multilingual characters.	MS-DOS IBM-PC/compatible 1 disk drive 64K	Lifetree Software Inc. 411 Pacific Street, #315 Monterey, California U.S.A. 93940; $195 (U.S.), Volkswriter International Edition - $225 (U.S.)
WORDSTAR	WordStar is a menu-driven program that allows cursor movement by character, word, page, and beginning/end of document. Block movement, justification and full search capabilities are included. Print features include underline, boldface, sub and superscript. SpellStar is a 20,000-word spelling checker. Mail Merge allows creation of form letters, mailing labels and boiler-plates. Star Index is an index generator.	CP/M or MS-DOS 1 disk drive 64K	MicroPro International Corp. 33 San Pablo Avenue San Rafael, California 94903 U.S.A.; WordStar – $495 SpellStar – $250 Mail Merge– $250 StarIndex – $195 All four CE $895 (all in U.S. $)

APPENDIX 6

SELECTED BIBLIOGRAPHY

1. *Microcomputers in Small Municipalities*, Ministry of Municipal Affairs and Housing, 1984.

   Comprises four publications: A Guide, A Workbook, A Catalogue, and Case Studies.

   The *Guide* describes the issues and concerns associated with the acquisition and use of microcomputers. The *Workbook* provides the tools to be used when completing the tasks of acquiring and using a microcomputer. *The Catalogue* provides the information about vendors of hardware and software and municipalities using microcomputers. The *Case Studies* describe the experiences of selected small municipalities that have installed microcomputer systems.

2. *Microcomputers in Larger Municipalities*, Ministry of Municipal Affairs and Housing, 1985.

   Comprises four publications similar to the above for larger municipalities of 5000 and over. In this series a *Manual* is provided in place of a Guide. The *Manual* deals with the use of microcomputers in larger municipalities and the managerial and technical issues associated with their use.

3. *An Introduction to Microcomputers*, Department of Computer Services, University of Waterloo, 1984.

   Provides a non-technical introduction to microcomputers. It is intended for use by those who know very little about computers in general and microcomputers in particular.

4. *Using Microcomputers in Urban Planning*, William L. Whited, published by Planning Advisory Service, American Planning Association (APA), 1982.

   A compact publication comprising of three parts. The first part provides a general introduction to a microcomputer for a planner. The second part describes how to set up a computer-assisted planning office.The third part is a commentary on future trends.

5. *The Planner*, July/August 1982. Journal of the Royal Town of Planning Institute (RTP).

   This entire issue is devoted to computers in planning. The article reviews current practices and several case studies.

ACKNOWLEDGEMENTS

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BRANCH PUBLICATIONS

Most recent publications available from the Research and Special Projects Branch of the Community Planning Wing.

A Planner's Reference to legislation provincial policies and guidelines updated June 1985.

Planning and Design for Commercial Area Improvements
March 1985

Towards Community Planning for An Aging Society
reprinted 1985

Downtown Management: The State of the Art in Ontario
February 1985
(complement to the following report)

Towards Excellence in Downtown Management
December 1983

The Re-use of Public Buildings
September 1984